SWEAT EQUITY

Building a house at half cost

Larry Angell

SWEAT EQUITY, Building a house at half cost,
is an ANGELL PRESS Publication.

Illustrations by Joshua Angell

Dedication

I dedicate this book with all my love and gratitude to my parents, Aaron and Maurine Angell.

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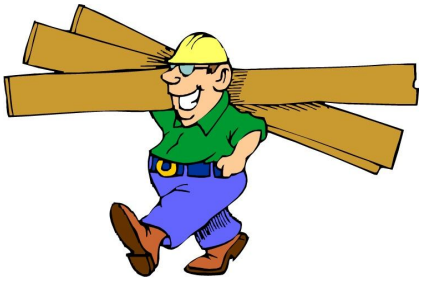
Introduction



This is a book about building your own house personally. It doesn't tell you how to find a contractor to do the work for you. It gives you the step-by-step process how to do everything by yourself and reveals all the amazing advantages that hardly anyone knows about in this day and age. It's my passion to teach everyone I can about what I've learned in the area of house building and the high cost of hired labor. So, let's get started!

We all want to live in nice homes, but not all of us can afford to. Sometimes, our incomes don't exactly match our ambitions for fulfilling our hopes and dreams. My wife and I realized that very thing a few years ago when we wanted to stop throwing away rent money and become homeowners. We had very few options because of our low income.

After a couple years of research and careful planning though, we decided to build a house completely by ourselves. With very little carpentry experience, the task was challenging yet unceasingly rewarding. It was also a lot of fun. We learned some extremely important tricks on how to save on labor costs which makes this whole thing possible. Even people with low incomes can have nice homes. Once our home was finished, we had more than 50% equity because of our own labor. That is typically a point that takes most homeowners close to 20 years of mortgage payments to get to. Not only did we have a nice home, but we also had a powerful financial tool to help us out. Let me explain.

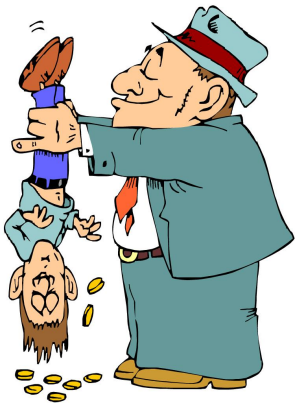
In our modern day, it's very common to borrow every penny to pay somebody else to build a house. Anymore, with such easy financing, usually even the down payment is borrowed money. Once the house is finished, the owner moves in with hopes of being able to make every payment each month for thirty years. Many sacrifices have to be made to make those payments.
Soon the homeowner realizes that he or she is the property and the house is the owner. I've seen many people working day and night just to pay for a home they couldn't afford.

I don't share that point of view. Life is fun and wonderful and it needs to be enjoyed. A house needs to enhance our lives and comply with our lifestyle.

My whole purpose for making a book on house building is to pass on what I have learned about the cost of labor and how we can save hundreds of thousands of dollars in the long run by doing the work ourselves. Each time we add a part to our house it's building not only our house, but also, its building equity in our own pockets. On the other hand, when someone else builds that part for your house, they are building debt for you.

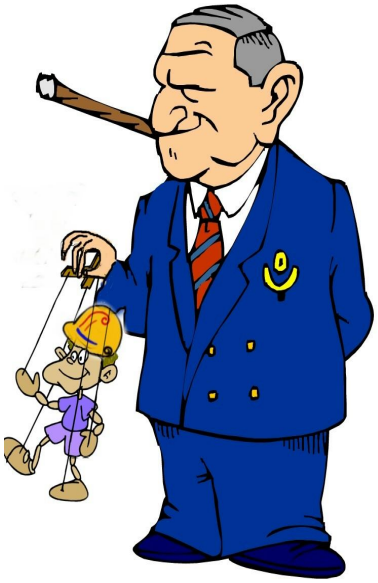
If a person decides to build a house without help from contractors, that person will own more than half the house because of the labor costs saved, once the project is done. From that point, if the owner needs to borrow against the equity, tens of thousands of dollars will be available for anything that person needs. A good idea anymore, is to open a revolving equity line of credit. This is basically a second mortgage, but it has a credit limit like a credit card, yet has low interest and a long pay-off schedule. This is a good source of security if times get tough. Once this equity line of credit is open, the funds can be used for whatever purpose regardless of employment status or credit worthiness. This is how you make your home enhance your lifestyle. This is a home that is an excellent financial tool. That is how it should be, but most of the time, it's not like that at all.

I have always wondered why more people aren't doing the same thing that we did. That needs to change, but before we can change anything, we need to consider why people allow themselves to be kept in the dark about so many things. We need to ask ourselves, "Why do we believe it when others tell us we can't succeed?" Here's my two cents on that matter.



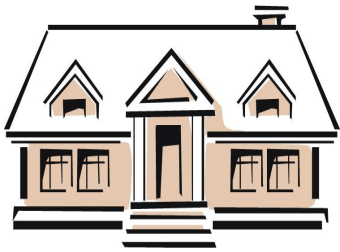
It seems that the vast majority of human beings accept life for what it is and try to live according to either the opportunities or misfortunes placed before them. This is evident when you consider that most of the inhabitants on this planet are living in poverty while allowing a small number of more fortunate individuals to rule over them. The rich and powerful would prefer to keep it that way and as long as greed and selfishness exist in the world, the segregation between rich and poor will continue to increase. As a matter of fact, if the wealth of the world was distributed evenly among the seven billion men, women, and children, all would be able to live a life of comfort and prosperity that can't even be imagined by many. There is that much wealth in the world, plenty for everyone.

The text written on these pages won't solve world hunger, nor will it unite all mankind in a spirit of brotherhood, but the counsel given can help some low and middle income workers create a better standard of living in these difficult times.

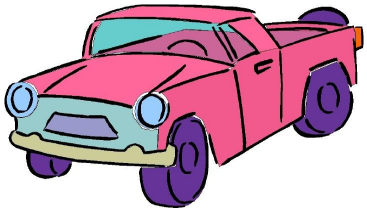


So many of us find ourselves stuck in a rut we call daily life. We spend all we earn and a little more. We put ourselves in financial bondage with high mortgages and hope to be able to keep up the payments. It seems as if we are working all the time and not fully enjoying the things we borrowed money to acquire. Creditors tell us what we can and can't do. The rich rule over us with a tight fist. Our hard work maintains their exotic lifestyle.

Why are we struggling so hard only to get further behind? Our parents struggled and their parents struggled yet they were able to retire in comfort. Will we be able to stop working when we get old? If things continue the way they are, many of us will still be in the workforce in our declining years. Social Security probably won't be enough to pay the bills.



I don't know of a time in our great country's history when the income-to-expense ratio has been so far off kilter. This is what I'm talking about:



In the early 1970's, before inflation hit us hard, a person could buy a nice home for around $25,000. A new ¾ ton pickup cost about $3,500. The medical costs for a new baby delivery were right around $500. Minimum wage was $2.00 per hour. Income to expenses was manageable with one income.

Now, in the 2000's, that same kind of home costs over $200,000. A new ¾ ton pickup costs over $30,000. A new baby delivery free of complications costs around $8,000. The kicker is that minimum wage is only around $5.50 per hour.

So, the cost of homes since the 70's has increased about 900%, the price of a new pickup has increased by over 1,000%, medical costs for a new baby has increased by a staggering 1,500%, but minimum wage has only increased by about 275%. If minimum wage truly kept pace with inflation, it would be around $20.00 per hour. That would be nice for many low-income families.

It's no secret that to be able to make those monthly payments, we need one big income or two or more smaller incomes. Those who were fortunate enough to have received a

family business or those who had enough foresight to get a college education can make it on one income. All the others are those that work hard to maintain a modest lifestyle.

On average, the biggest monthly expenses are the home mortgage or rent, food, auto payments, and medical bills, usually in that order. Both parents need to work to meet those obligations.

Children are raised in daycares and schools. In the evening when the typical family is home, the parents are busy doing necessary chores or are resting from a hard day. Children need attention and parents need to be spending quality time with their loved ones, but there aren't enough hours in a day so they do the things that have to get done instead of being with the family. The few hours each day spent with the kids are usually nerve-racking and seem to drain the energy from the already tired parent.

Life has a way of making us focus on unimportant and often trivial matters at the expense of that, which is most important. I knew that I had made a few bad decisions that brought me to the point of being a low-income wage earner. I realized that I was depriving my family of a better life as a result of some of my bad choices. But I also realized one very important thing and that was that I didn't have to continue making bad choices.

In 1991, I was a typical low-income wage earner. My wife and I were renting a small home and with our first child, we were trying to live a good life. We wanted to own our own home, but couldn't afford it. We looked at Mobile Homes, but they were too pricey and were of poor quality. Even to buy an old home, as a fixer-upper was too expensive. It was then that I found out about building my own house from a friend who built his house.

He was a good carpenter and told me he would give me any advice I needed. After looking into the situation a lot deeper, I decided to do it. My wife and I made a plan on how to save money so we could get started as soon as possible. My parents encouraged us to move into their basement so we could save money. We restructured our spending on food and fun and decided to live beneath our means until the house was finished.

It was a long, difficult process, but was undoubtedly the most rewarding thing we have ever worked for.
It took over four years because of a permanent lay-off from work and vocational retraining to help find another job. We did whatever we could do to keep the building project going. Finally, in 1997, we finished our house and took out a home mortgage loan

to consolidate all the bills we had incurred for building materials. We moved in and got on with our lives.

Since that time so many people have told me how great an achievement it is to build a house. I hadn't considered it to be anything great; it was just a project that was fun and rewarding. I had gained a lot of knowledge in the process and learned a few things about myself along the way.

The one thing that really stays in my mind however is the amount of money we saved by doing it ourselves. It's unbelievable and it makes me wonder why more people don't do the same. The money people pay to contractors for labor is almost 2/3 the cost of the home. The fact is: **Your house is your best financial tool or your worst financial burden.** What usually makes the difference between the two is the amount of equity you have in your home or plainly the amount your house is worth minus what you owe on it.

"Your house is your best financial tool, or your worst financial burden"

This book has two parts. The first part is the most important by far, because it is something you will never forget. It will benefit you from this point on. It is about "**why"** you should build your house. The second part will tell you "**how"** to build your house. At the time I was building my house, there was no "how to" books that were complete. I spent a fortune on books only to learn from inspectors that a lot of my information was incorrect. I have tried to make a complete "how to build your house" book that is accurate but not overwhelming. I like simplicity.

It is thorough as far as basic house building is concerned. Because of the large amount of information involved in the construction of a house, each area is brief, yet sufficient to give the reader a complete idea on each phase of the building process. Local codes and ordinances differ greatly from one building site to another, so it is necessary to get localized information from the local building, health, plumbing, and electrical inspectors.

Remember, building your own house either completely or partially by yourself, will be one of the greatest, most beneficial choices you have made so far in your life. That's my promise.

ONE

Part 1

Who can benefit from this book?

Almost anybody can benefit from this book with the exception of those individuals who have more money than time. I have seen wealthy people build their own houses before, but it's more out of a sense of accomplishment than to save money. Those who will truly benefit are people that are usually in the lower and middle class income brackets.

The problem with our modern day financial structure is that it limits our ability to dream realistically. We can all fantasize about fancy cars and the castle we want to live in when our ship comes in, but in the back of our minds we know that our ship has sunk and has taken down with it all of our hopes and dreams. So, we realign our perspectives according to what reality and the rest of the world tells us about our potential. When in truth what most of us need is a small boost in the right direction to get us thinking in a positive manner and then, watch us take off!

I'm a man of very few talents. I haven't found anything that I'm real good at yet. The world beats us down everyday and reminds us of our failures.

Some days I come home from work feeling like a worthless slug. But that feeling never stays around very long and the world quickly loses power over me. When I walk across my front deck and into my beautiful home that I made with my own hands, I'm reminded of my potential and how much any person can accomplish with the correct mindset. My beautiful wife and children meet me at the door with smiles and kisses and that right there reminds me once again, that a person doesn't have to make all the right choices in life, just a few good, important ones.

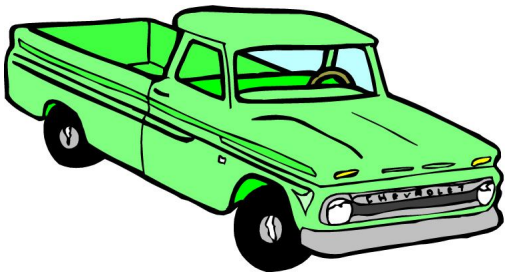
Building your own house is a good choice and a very important one at that. The financial benefits alone are very much worth the effort. We spent around $60,000 for our house. It appraised for $140,000. Those are the numbers I use in all the examples because they are numbers I know very well. The land, the well, and the septic system are included in that $60,000. It's much easier to make a monthly mortgage payment on a $60,000 loan, than on a $140,000 loan.

That is what makes this all possible. Someone on low income normally has no chance of getting a 2000+ square foot, frame-built home. They usually have to opt for something smaller or something that is such low quality that it probably won't even outlast its mortgage. That's sad and it didn't used to be that way. A hard working individual with low income used to be able to buy a home. Not anymore, those days are gone and so we have to make a new plan to succeed.

Have you ever noticed groups of wonderful people that donate their labor to build houses for families that can't afford to make high mortgage payments? One of the most popular is "The Habitat for Humanity". For many of these kinds of groups the labor is donated so that once the house is finished the cost of materials is the only thing left to pay for. The mortgage is substantially less and one that a low-income family can afford.

Let's turn the focus back on those people who are just getting by, yet have fairly good jobs. Usually they live from paycheck to paycheck, but aren't getting anywhere in terms of saving money and improving their lifestyle.

Here's a true story about a person I know. I had been living in my new home for about 3 months. I was telling my friend how much my house cost to build. He said he wished he could find the money to build a new house. I told him about the plan my wife and I made to be able to free up extra money the whole time we was building our home. He told me that he and his family lived in a fairly nice singlewide mobile home. He had a pickup and a car. His car was paid off, but his pickup was new and very nice. His pickup payments were $600 a month.



I saw this as an opportunity to help him with my expert advice. I laid the whole plan out for him. If he would sell his truck and buy a beatermobile pickup that was dependable enough to get him to work but cheap enough to have a low monthly payment or perhaps no payment at all, he could save enough money every month to start buying materials immediately to build his house. Plus, he would have a perfect truck for hauling building materials.

I figured that after two years his house would be far enough along and would have such a considerable amount of equity that loan brokers would be falling over themselves to give this guy a construction loan, regardless of his credit rating, which wasn't very good. After a few months, his project would be completed and he could consolidate all his bills into a Home Mortgage Loan with low interest. Plus, he could sell his Mobile Home and take the equity (if there was any).

Well, that was a good plan and it would have worked for him and he would have only had to borrow such a small amount to actually finish his home. It would have been because of the monthly equity he was putting into the house itself. It made a lot more sense than throwing it away on something that would be worthless by the time its mortgage was paid off like his shiny truck. But, I didn't consider the human factors of pride and reputation in my calculations and estimates. He shot my idea down with no hesitation at all. I asked him, "Would you sacrifice the next two years of pride if you knew that you could live comfortably for the rest of your life?" He said, "I'll find another way so I can always have my nice trucks and a place to live."

I remembered thinking, “This guy, like so many others, doesn’t get it.” I left it at that and never talked to him about it again. But, you know, it’s been over five years since that conversation took place. He still drives the same truck, and lives in the same singlewide. Both have lost their luster, both have been refinanced, and neither are worth what they still owe against them and the struggle goes on.

I don’t think that’s funny, it’s sad because his story is the same one I see everywhere.

I don’t want anyone to suppose that building your own house is going to solve all your problems. It won’t, I mean, it hasn’t solved all my problems. But, it sure has given me more positive options to help face an unfair world. It sure seems as if this world wants to stomp on our hopes and dash our dreams before we even have a chance to get them started. One of the biggest obstacles to overcome after you decide that you’re going to build your own house is people telling you not to do it. When you see all the hoops that the inspectors make you jump through, you just might bag the whole idea. It’s that discouraging. But if you can see the big picture, you won’t have any trouble sticking with the plan.

Inspectors will tell you all sorts of discouraging things because they are used to doing inspections for contractors. Contractors know what the inspectors are looking for. They might tell you that you have to complete your project in a specified amount of time, but the truth is you can keep filing for extensions. Inspectors have both the contractor and the owner right where they want them, because inspectors can halt the funding if the home is being financed, and I have heard that they can even stop the building progress of a home that’s paid for, although I have never actually seen that happen. All these things can be overwhelming to a first-time homebuilder. Just remember that inspectors care that the job is done right and they will help you get it right. I’ve never met a mean inspector yet.

Not only are inspectors discouraging, but also friends and family might try to talk you out of it because it goes against the norm. A hundred years ago, the norm was to build your own house. Only the rich could afford a carpenter-built home.

With the discovery of electricity, homes have changed and so hundreds of rules have been put in place to protect us from ourselves. We are ignorant of these rules and that’s why building a house all by ourselves goes against the norms of society.

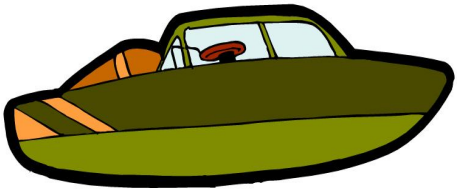
Typically, those individuals that go against the norms of society are either extreme oddballs or modern day heroes. What we become is up to us.

Just remember that whatever you have to do, no matter how difficult or discouraging, it's totally worth it and a hundred times over.

TWO

Do we really save that much by building our own homes?

About two years before I first started any work on my house, I was talking to one of my friends. This guy is the kind of person everybody wants to be around. He constantly has an upbeat attitude and a sense of humor that never quits. He has amazing energy levels and is always working on projects after work. I don't think he ever rests. Anyway, he is a good carpenter because he built his own house and liked it so much that he took carpentry up on the side while working a full-time job with benefits.



We both worked at the same place and when our plant was permanently shut down because of The North American Free Trade Agreement, he never even skipped a step in his financial stride. In fact, he did better as a contractor building houses than he did working for a Fortune 500 company with many benefits. He is in a great financial position and has been for a long time. He built his house about 25 years ago and paid cash for most of it. He didn't have a Home Mortgage payment so he was able to live on what he earned while still being able to tuck a lot away into investments. Before I found out his secret, I had wondered how he could have such a nice home and lots of fun toys. His wife didn't work and he made less at work than I did. Man, I struggled on what I earned, why didn't he?

I asked him how he did it and he told me with as much enthusiasm as I've ever seen anyone muster. He told me his secret. Then he told me something that seemed so unrealistic, it took a lot of thinking to believe it or even understand it. The part about him building his own house was nothing special. He was a carpenter, that's what they do. No problem. But then he said, "Here's something you need to think about to fully understand. Every hour I spent working on my house was worth between $200 and $300 an hour to me."

"Every hour I spent working on my house, was worth between $200-$300 an hour to me."

I couldn't understand it completely and didn't fully understand it until after my house was finished. Here's the deal: My house cost me $60,000 to build by doing all my own work. Let's say I had to borrow every penny of it from credit cards or relatives or whatever. My new house appraised for $140,000. To finance both amounts at ten percent interest over thirty years, you will pay for your house roughly three times. So, the house that I put so much of my sweat and blood into will have cost me $180,000 after 30 years.

To have the exact same house built by a contractor, you will have paid around $420,000 at the end of 30 years. The difference between $420,000 and $180,000 is $240,000. That's the cost of having someone else build your house. Anyway, divide that by the amount of hours it takes to build the house, which is about 1200 hours in total. $240,000 divided by 1200 equals $200 an hour. Check out the graph:

Your Frame Home (2100 sq. ft)

	Built by You	Built by Contractor
Cost of materials	**$60,000**	**$60,000**
Cost of Labor	**$0.00**	**$80,000**
Total cost	**$60,000**	**$140,000**

Financed over 30 yrs at 10% interest

	Built by You	Built by Contractor
Amount Financed	**$60,000**	**$140,000**
Total Interest Paid	**$120,000**	**$280,000**
Total Paid for your home	**$180,000**	**$420,000**

These figures are real because most people will pay longer than thirty years on a home mortgage making the total interest paid even higher. Now, you are probably thinking, "ten percent interest, wow, that's way too high!" Ten percent is a good even number and easy to calculate. It's also a percentage people would have loved to lock in at during the 70's and the 80's when variable went higher than twenty percent for home mortgage owners with good credit and good jobs. Many savings and loans became homeowners and landlords during those two decades. Some became ghosts.

Now, we see how much we can save by doing our own work, but let's see what that means as far as a monthly mortgage payment is concerned. Let's also compare the two monthly mortgage payments just to see what I'm talking about.

Monthly Mortgage Payment

Built by You	Built by Contractor
$475.00	**$1100.00**

That interest factor is very interesting. But let's go a step further and have some fun with it. This is a real example and it has worked extremely well for a few people I know. Let's suppose that I have two neighbors. Each has the same house plans to the exact nail.
One has a low self esteem, but a pretty good job, so he decides to have a contractor build his house. The other neighbor really believes in himself, unfortunately, he is the only one who does, so he doesn't have such a good job, but he decides to do all the work himself.

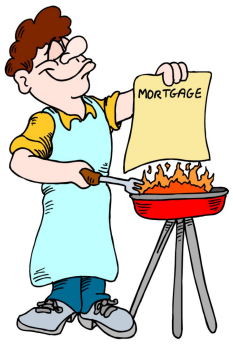
Owner built **Contractor built**

After both houses are finished and financed, the neighbor with more money than self esteem has a monthly payment of $1100.00, **ouch!!!**

The other neighbor that has more self-esteem than money has a monthly payment of $475.00, not bad.

Suppose that the neighbor with the lower payment decided to pay as much per month as his neighbor was paying. Both were paying $1100.00 a month until the loan was paid off. By making extra payments, the principal is beat down so that the loan has less interest being charged.

Both pay $1100.00 a month



	Built by You	Built by Contractor
Payment Amount	$1100.00	$1100.00
Years to Pay	9 Years	30 Years

It would be nice to have a home paid off in less than nine years. Many people escalate the payoff date by paying extra each month. Anything extra goes toward principle and beats down the amount incurring interest. That's the skinny on that plan.

Some people might be wondering what the deal with contractors is. Why do they charge so much in labor? Are they crooks? I suppose some probably are crooks, but most are good people with a high amount of overhead. Many have crews working for them and the crews need steady paychecks. Some even offer benefits to their workers. It's a competitive occupation and contractors need to remain competitive so they can get contracts. Some, on occasion, will make mistakes and underbid a job. Then they have to eat it. Contractors and their crews can do in a few weeks what takes one person over a year. The total project hours work out about the same except for the learning curve. First-time homebuilders will naturally take more time to do the same job. The idea is to minimize waste and mistakes as much as possible.

Now, after giving contractors the benefit of the doubt concerning overcharging, I will say one other thing of significant importance. Many contractors and sub-contractors are members of unions. That's why an electrician can show up at a building site with a few hundred dollars worth of materials; work for a day, then charge the owner a few thousand dollars for work done. It's the same with plumbers, carpenters, cement workers and many others. Unions typically strive to maintain a high quality work standard among its members, but every member can't be watched over every second of the day. If you hire a union member to do the job, you're not necessarily guaranteed top quality work; you are however, guaranteed to be charged for top quality work. Someone has to pay those union dues and keep the lobbyists busy creating ways to benefit those that pay them the most money.

THREE

Mortgage interest is nothing but nasty

This chapter is where I climb up on my soapbox and declare to the world my quest for justice in an unfair world. The world is unfair in many ways and all too often the humble are trodden down by the rich and greedy in the unending pursuit of worldly gain. Let me first say that I know some moderately wealthy individuals who would give all to help the poor. They do give all they have and they are blessed with more wealth so they can continue their good deeds. This isn't about them. This is about the rich who turn a deaf ear to the cries of the poor. The greedy that know of the suffering of the very people they squeeze money from and only tighten their grip to take more. The owners of shamefully lucrative businesses that oppress hirelings in their wages to maintain control and satisfy their own bloated egos.

I've seen poverty in one of its worst forms. I spent two years of my life in a third world country where I saw that which was unimaginable to me. Communities living in boxes along muddy ditches where drinking water and wastewater was the same. High death rates were common among all who dwelled there, but more so in small children under the age of six years. People would go for days without anything to eat. I was nineteen years old at the time. I grew up real fast and since then have never taken our abundance in this great country for granted. That's been over twenty years, but the hopeless faces and the sounds of lamentation will forever be etched deeply in my memory.

Before I returned home from Central America, I looked into the situation as to why our prosperous country wasn't giving aid to the suffering.
While talking with diplomats who knew the whole story, yet were powerless as far as being able to influence their government's leaders, I discovered the truth. The thing that was happening there was common throughout the world. Our country was sending millions of dollars for Humanitarian Aid as well as food, clothing and medicine. It is extremely difficult to bypass corrupt government officials so that the aid can go to the needy. The money is taken, medicine, food, and clothes are sold or disposed of. The greedy get richer and the poor are told that other countries refuse to offer help. This propaganda is spread among the poor and the suffering by the very people that cause it. In turn, the poor end up hating the people who are actually trying to help.

I can't even remotely fathom this kind of selfishness. I have seen it time and time again and it sickens me now as much as the first day I found out about it. The people that inflict such suffering have their reward in this life, but someday they'll have to explain their actions to a higher judge. That still doesn't offer much comfort to those of us who are haunted by past images.

Ok, so you're probably wondering what this has to do with mortgage interest. Here's the deal. Many contributors to our Savings and Loan Banks are foreign investors. Many are domestic investors. Some of the money comes from drugs, confiscated foreign aid, weapons, and fraud, but a lot also comes from wealthy investors who have made themselves rich by usury or other practices that are legal, yet morally wrong. Basically, they have found a way to keep money out of the hands of the poor and needy and into their own to better support themselves in their extravagance.

As long as there are people hungry and suffering in the world, I see any excess wealth as extravagant.

The money we borrow for just about everything we need comes mostly from those individuals who would edify themselves at the expense of others. If you have millions to lend, you have millions to give to the poor.

In a nutshell, the low and middle-income earners work very hard to pay back mortgage interest that goes back into the pockets of the rich so they can smoke fatter cigars, drive bigger cars, drink older champagne, and hire more minimum wage help to treat badly.

If you haven't noticed by now, I have a strong dislike for greed and selfishness. The world would be free of strife if people didn't nurture those negative character traits. I really dislike the thought that most of my hard earned money goes back to people that possess those tendencies. The very basis of this book is how to do one thing right in our lives that will help us keep more of our hard earned money so we can be in a good position to first help ourselves, then our families, and finally our communities.

If we could minimize our home mortgage payment we would have money to do other things. Instead, so many people spend an average of about one third of their income on a house payment. If you're typical, you'll work about forty-five years of your life. That means that fifteen years alone of hard work will go to nothing but your house payment. It's a shame that about ten of those fifteen work years will needlessly go to the kind of people that think it's funny that others work so hard for them. That's where our home mortgage interest money goes.

One might be prone to think that the rich are at least the ones that pay all the taxes that keep our country going, so they can't be all that bad. The truth is the wealthy usually have ways of showing losses so that profits are minimized on paper. High paid accountants keep the rich from paying a lot of taxes. Lawyers defend and advise them when they cross the line from immoral to illegal. The middle class and some of the lower class wage earners pay the taxes that keep our great country going, not the rich.

FOUR

What is so special about equity?

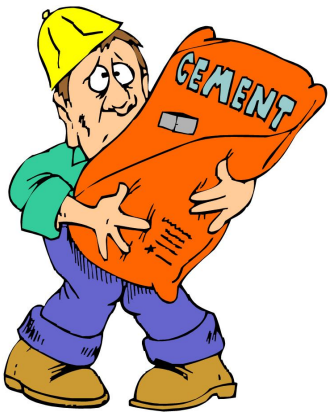
Equity is the determining factor in loans. It is the difference that makes a house your best financial tool instead of your worst financial burden. By building your own house, it will have over 50% of your equity in it. That's a point that takes most homeowners around 20 years to reach.

That is why doing all the work yourself boosts you ahead of the other homeowners that hired a contractor or contractors. It puts you ahead by many years because one problem we have is to get through the "difficult years". Usually, in our first years of starting a family, getting a house, and finding a career, we have a lot of difficulty making our paychecks stretch to meet all the demands. There never seems to be enough money.

That's a common struggle in the lower and middle class families. Usually, by the time people have been working for about 20 years, things are going better. Their wages have increased, medical bills have been beaten down, and they can refinance their homes or take out a second mortgage for business ventures or to create a smaller mortgage payment. Equity in their property makes it easier for them to move around financially so they're not so restricted by high payments.

One other thing, equity really is power. It helps out a lot more than you think. Here is my personal example of how equity helped my wife and I obtain our house. This is my own example and it might give some ideas to help your project get started. I should caution that I took a few chances by over extending myself by using credit cards to build my house. I thought I had a secure job to make the payments, but nothing is secure anymore I believe. My gamble worked out in the end, but it was really stressful!

Here's our story:
In 1992, my wife and I decided that we were going to build our house by ourselves. We made the plans and restructured our budget to allow money for building materials. We were able to free up a few hundred dollars each month. I did all the necessary homework to find out just how to build a house. It was confusing and at times very discouraging. At one point, we even went to look at Mobile Homes. But, we stuck to our plan in the end.



We started building in the fall of 1993. Things looked great at work and I even got a big promotion that meant we could pocket almost $1,000 a month for our house. I started the foundation, built the floors, the walls and the roof. I did some of my electrical systems and some plumbing. Life was good! We were almost giddy every time we went to the house to do work. My wife stayed home most of the time to take care of our two young children while I was playing Mr. Carpenter. I even felt like a real carpenter. By the spring of 1994, I had it pretty much enclosed. It looked good. It seemed that we would be in our house in less than a year.

I should have known something bad was on the way because we were actually starting our house and paying cash for everything. I kept thinking to myself, "We are having success and that has never happened to us before". Sure enough, The North American Free Trade Agreement was passed. I never saw that one coming although I should have. The U.S. lifted tariffs on foreign products, and Canada flooded our markets with inexpensive forest products. That made the big company where I was working suddenly become uncompetitive and so several plants, not just ours, were shut down. In only just a few months the company stocks that I had planned to fall back on in difficult times dropped to about one-fifth the value because of an accounting scandal. Life can turn on you in a hurry. So, I had no job and very little money left to support us. I cashed in what stocks I had, bought metal for the roof, and had a well drilled. Then we sealed up the door and window openings with plastic and waited to see what was going to happen.

I did odd jobs trying to make a buck to support us. In 1995, I received a letter from the company where I had worked. It said that I could receive funding to go back to school. This is available to all workers displaced by NAFTA. I could only get funding and unemployment for a year and a half, so I went to a Vo-Tech and learned about computers and electronics. Anyway, I decided to take a chance at that point, because our house had been sitting there for many months. We had a lot of credit cards that had available credit on them. So we worked on the house while I was going to school. In the fall of 1996, I decided to try to get a loan to completely finish the house. It looked finished from the outside, but the inside needed a lot more work.

I had all the electrical and plumbing pretty much finished. The walls had sheetrock. I had put about $28,000 into materials so far. I estimated that we would need around $28,000 more to completely finish it.

Being that I was unemployed, no banks would lend us the money, and they were even snotty about it. I could see the same look on the faces every place I went to ask for a loan. It was like they were saying "You unemployed, low-life, piece of filth, take a hike and make way for those that have money."

I stumbled onto a loan broker in my travels that said he could help us find a loan providing my story was true about having a house that was almost finished. Well, my story panned out and he had us a construction loan. His attitude was great, before he found us a loan he said, "It's not a matter of "if" we get the loan, it's a matter of "when" we get the loan because there is always somebody that will borrow you the money, we just have to find the best interest." He had to find us two different loans, first, a construction loan, and then a Home Mortgage Loan to consolidate all of our bills as well as the construction loan itself upon completion.

Our house appraised for $71,000 in its unfinished state. I was so surprised that my labor was worth so much. I spent $28,000 and it was worth $71,000, not bad.

He found a construction loan that was offered from a private lender. I kind of felt like it was one of those shady deals at first, but it was actually a wealthy, elderly woman that had her sons managing her estate. The loan was for $28,000 at sixteen percent interest for six months. It sounded like high interest, but quite often construction loans are like that because they are always short term. The loan went through smoothly. The house was its own collateral. It took us only two months to finish. The total amount of interest paid on the construction loan was about $1300. It was a small price to pay for a loan of that type.

The broker had to use some clever tricks to get us the mortgage loan though. We got a nonconforming loan because I was unemployed. It was nine percent for two years and then would go variable at which time I would be working and we could lock in at a lower, fixed rate. Still, we had to show some income. I couldn't show unemployment as income, besides lenders don't think it's very funny when people apply for a loan with no way to pay it back. We got a loan on "stated" income that determines ones income by how much money goes through a checking or savings account for a certain time period.

My wife had been doing kitchen shows for several months. She would take orders and the money for those orders, then deposit the money and write out a check to the kitchen products company when she placed the order. She only got commissions on twenty percent of everything she sold, but our checking account had several thousands of dollars going through it each month. It had the appearance of a good income. This type of loan is usually used for businesses that have unusual forms of income and profits. We consolidated the bills we had accumulated by building the house. The credit cards were paid and the nasty phone calls from creditors suddenly stopped.

We finished our house in the spring of 1997. The loan broker told us that the only reason we was able to get a loan was because the equity in our home was so high. I had no job, but I did have something of value, my house.

I knew a man that started building houses just for fun. He was a teacher, but in his spare time, he was a house builder. He would move into a house after he had finished it then start another house. He would live in the house for two years, then sell it and move on to build another house. He did this several times, each time cashing in big on the equity for his labor. He is now well off and will never need to work again. There are many people that do this and its big business to them. The one stipulation is if you are not a contractor and you don't have journeymen's licenses in plumbing, electrical, and other systems, you have to live in the house for a specified amount of time that varies from state to state before reselling.

FIVE

Ways to free up money

It's no secret that building a house costs a lot of money. Many people that have a home built for them get a second job to raise enough money to pay the down payment. The problem with that is the thing that's all too familiar to us. We raise our spending levels so we have to keep that second job just to get by. After awhile, the quality of life hits an all time low. I mean, who wants to spend all their time working?

The idea here is to free up income so you don't have to get that night job. Besides, if you want to have time to work on your house, you need at least two hours a day for two years or four hours a day for one year or eight hours a day for six months, you get the idea.

My wife and I had to make some sacrifices during our house building years. At first, it was really hard, but once we could see our house coming together, the goal to finish it became an all-consuming desire. If the goal can be visualized, it becomes easier to obtain. So after putting all the plans together, imagine walking through the halls, the beautiful kitchen, and the comfy bathroom with a big, jetted bath, the feel of carpet under your toes, the master bedroom, and a family room that has all the extras. If you can imagine it in your mind with excitement, your subconscious will have influence over your appetite to waste money and you will reach your goal.

Our first step to save money was to stop paying rent. My wife, one-year old son, and I, moved into my parents basement and instead of paying rent, we paid their utility bill. To most people, this is too big a sacrifice to make and so it's not really an option. I have great parents and we have always gotten along good. It was my Dads idea as a way to help us save money. Besides, it was fairly close to our land where we were going to put our house. It's quite embarrassing though, when someone would ask where we lived, I'd just tell people, "We live close to my parents."

Our next plan of action to save money was in the area of food. We decided to stop buying ready-made meals and started to cook from scratch. My wife and I are good cooks and we know how to budget well. We made things that were inexpensive to prepare and I started taking sack lunches to work. Soda pop was minimized and you wouldn't believe how much that saved us right there. We didn't go out to restaurants the whole time. Pizza and everything else that can be picked up and taken home got the ax. We ate a lot of pasta, potatoes, tuna, ground beef, eggs, rice, lentils, chicken, vegetables and fruits from our garden, and many kinds of homemade soups. Bread and tortillas were easy to make. We actually ate healthier meals while saving money at the same time. Many people don't know how to cook, but with a few staple items, anybody can prepare inexpensive meals.

I never had any idea how much was spent on food every month. We were able to save more than $500 a month by not dining out, or by not buying ready-made meals, and by packing my lunch to work. We wouldn't go to the convenience stores every moment either. One thing we discovered was that we would spend more a month running to the convenience stores to buy a pop and a candy bar, than our entire grocery bill would cost. $500 a month buys a lot of building materials.

The next area to make cutbacks was fun and entertainment. We didn't go to movies or even rent movies. We found that working on our house, as a family, was a total blast so it was good entertainment. We didn't go on vacations of any form. We didn't buy new clothes. No new music cassettes. Christmas was not too extravagant, but adequate. We did the same with birthdays.

There were a few other areas like changing life insurance so we had only term insurance. That saved a lot. I thought I needed a pickup, but we got by without one and its monthly payment just fine. We burned firewood in the fireplace and turned the electric heat down low. We lowered the coverage on our car and took glass coverage completely off.

There are a lot of ways to lower monthly expenses. We have always been taught to live within our means, but few of us actually do that because of easy credit. The whole time we were building our home, we lived below our means and we were happy with the results.

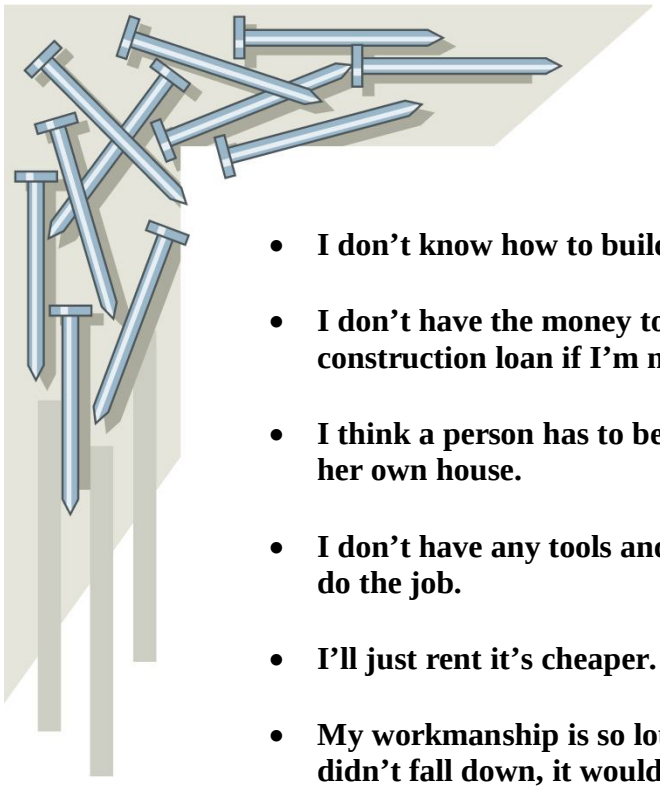
SIX

Reasons people have for not building their own house

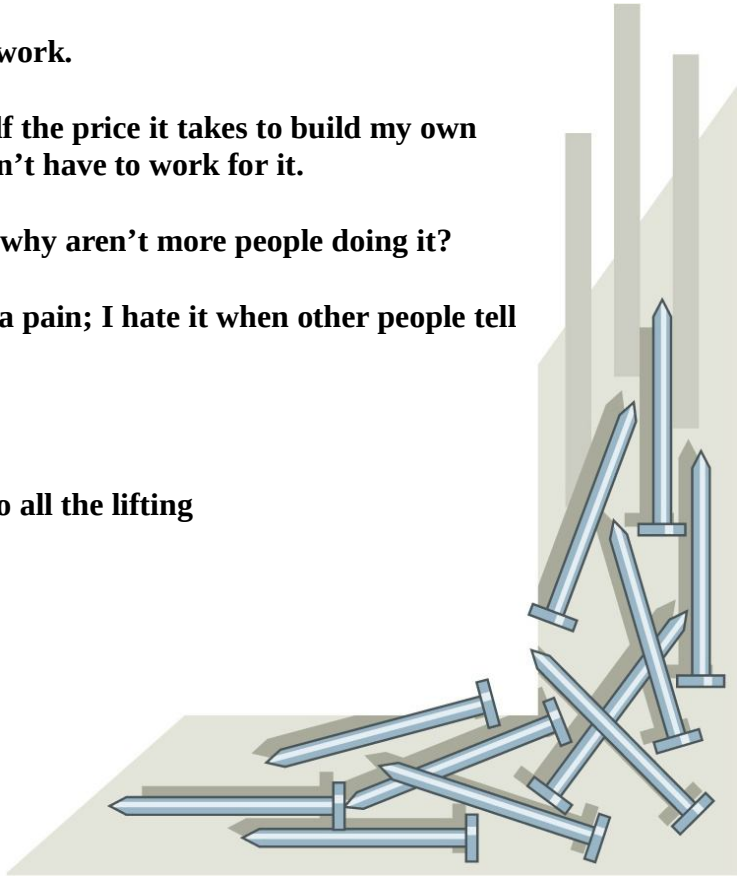
These reasons are very real and I have heard them all several times. Building a house is definitely not for everybody though. There are a few good reasons not to do the work. If you have a good reason not to build it yourself, I respect that. If everyone built their own homes, contractors and subcontractors would be flipping burgers. I like contractors and I have a lot of respect for them. They put up with a lot of garbage from clients, inspectors, and quite often their own employees. Whenever I drive past some hard working carpenters in the dead of winter all bundled up, or in the heat of summer sweating like a horse, I realize that they're tougher than I am.

But the biggest reason people opt to not do their own work is ignorance. They don't know that they are allowed to do it first of all, and secondly, the very idea of attempting to do the complex and demanding work doesn't seem realistic to them. And finally, they have no idea how much money they can save and how great life is with a much smaller home mortgage payment.

Let's bring a few other beliefs into the light of scrutiny here. These are some reasons I have picked up on over the last few years:

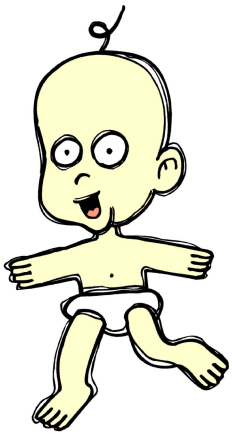


- **I don’t know how to build a house, that’s a professional’s job.**
- **I don’t have the money to build, and nobody will borrow me money for a construction loan if I’m not a contractor.**
- **I think a person has to be a licensed contractor or journeyman to build his or her own house.**
- **I don’t have any tools and it must be expensive to buy everything needed to do the job.**
- **I’ll just rent it’s cheaper.**
- **My workmanship is so lousy, my house would probably fall down, even if it didn’t fall down, it would look like a dump.**
- **I don’t have a pickup truck to haul all the materials.**
- **I don’t know anything about plumbing or electricity, I don’t want to sleep in a house where I did the work, it might be a deathtrap.**
- **I don’t want the stress of doing all the work.**
- **I can buy a Mobile Home for about half the price it takes to build my own house, I can have it right now and I don’t have to work for it.**
- **If building your own house is so great, why aren’t more people doing it?**
- **Dealing with inspectors is too much of a pain; I hate it when other people tell me what I can or can’t do.**
- **You have to be smart to build a house.**
- **I don’t know if I’m strong enough to do all the lifting**
- **I don’t have anyone to help me.**



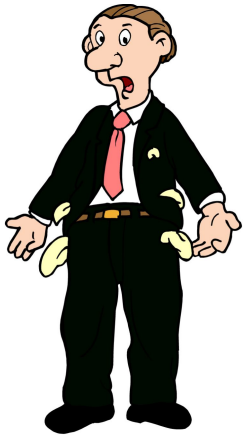
Some of these are good reasons and some are pretty lame. At any rate, it's a good way to clear up some misconceptions about doing all the work. Let's talk about each reason.

- **I don't know how to build a house, that's a professional's job.**



That's the most common reason I hear for a person not to do the work, but not knowing how to do something is a poor reason for not doing it. If it were a good reason, none of us would be able to walk, talk, drive a car, or program a VCR. (I still have a hard time with the VCR thing) Building a house is like everything else we learn. We have to take it one step at a time. It's good to have an image of the completed project in the back of your mind, but if you look at everything all at once, you'll get very overwhelmed because it is a huge undertaking. When I got started, I knew what every step of the project would entail because I had a good plan, but at each phase of the project, I tried to only focus on the task at hand. It helped to keep my overall perspective in balance.

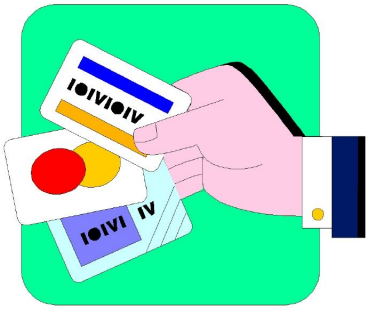
First, I bought a book on how to do foundations and cement work. I also asked people for advice. When that step was completed, I bought books on framing and called more friends for advice. Every step of the way, I gave full effort to do the job right because it was costing me a lot and I hate to waste money. There were many times when I was caught with a hammer in one hand and a book in the other as people drove by. Many times though, I would be in a stupor while contemplating my next step. There was a lot of head scratching going on during my whole project. I think that friends and neighbors doubted my abilities at the time. Hey, so did I. But, all worked out very well in the end and now people around here know that I finished my long project. If they remember nothing else about me besides that, I'm happy.



- **I don't have the money to build, and nobody will borrow me money for a construction loan if I'm not a contractor.**

The money part is usually the biggest hang up. I can only tell you that there are many different ways to get the money. Times are different than they used to be.

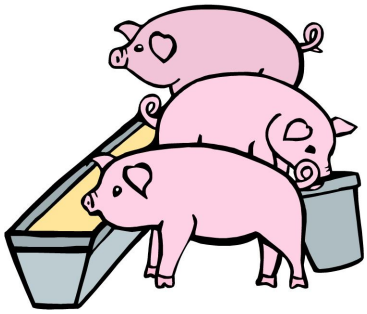
There are now many financial institutions that make construction loans to owner/builders. The high equity from the owner's labor is very attractive to lenders. Anymore, they are not as concerned about unskilled contractors because of strict building codes that all builders have to follow. They are very concerned however, that the collateral has enough value. "Sweat equity", is the term used in this case. To a lender it means that every bit of work done on the house is security. To the owner, it means value appreciation without having to pay cash for it. Sweat equity is the dollar amount that your time and labor is worth. Bankers drool at the sound of it!



I decided to buy as many materials as possible without a starting loan. I used credit cards and whatever cash I could spare to get our project to the point of borrowability (that's my own made up word by the way). I had my home finished to the point where I was starting to tape and texture the walls. It was at the point of borrowability way before that, but I wanted to be sure it had enough value to satisfy the appraisers. The value of the land is important, as well as the site improvements like a well and septic system if you live in the country. If you live in the city, the value of the property and the house value is what determine borrowability. Finishing the home within the loan time period is not a problem because if you determine how far along the house is by a dollar amount, you will have your home almost finished work wise, but financially, you'll only be about half done. The final fixtures and finish work is where the high expense comes from. Cabinets, carpets, heating, lights, appliances, bathrooms, and a bunch of other things will need to be done at the end. Those things are all easy to install but they're spendy. Fortunately, to start construction on a home is quite cheap compared to finishing it.

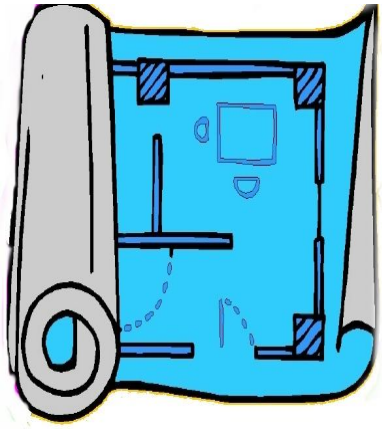
- **I think a person has to be a licensed contractor or journeyman to build his or her own house.**

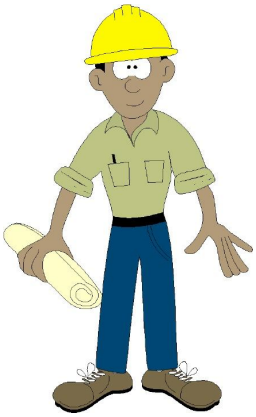
That's not true in most cases. There are a few cities and counties that prohibit a non-licensed person from doing any type of construction or systems. There are also ordinances of conformity that state that every house has to have a certain type roof, special siding, two-car garage, etc. But, cases like that are rare and usually the neighborhoods are in the upper class. I wouldn't want to live there anyway. I wouldn't like it if I was told what kind of house I could build.



If you choose to live in a "Homeowners Association" like that, you are giving up many rights as a homeowner however; by living in places like that, you probably won't have the problem of someone raising pigs or putting in a car salvage yard next door either.

The truth is that in most areas, the owner of a home can do whatever he or she wants just as long as it meets code. Before you start your project, you should be familiar with the building codes in your area, and you need to have a building permit. You will need to show the Building Inspector your plans. He can then help you make adjustments if necessary. When your site is approved, you will get your permit to hang on a wall when you put it up. You will also need to get permits from the Health Inspector, Electrical Inspector, and a Plumbing Inspector. They can be a wealth of knowledge and they will gladly help you with compliance issues because it's their job.





The inspectors just want to be sure that your home is safe and that no mishaps will happen later because it's their name on the permit meaning they are responsible. If you look at it that way from their point of view, you'll be a lot more cooperative. I don't blame them for making sure everything is perfect. I would too if my name was on the permit. They can still be a big pain though. I've never met a mean inspector; they all seem very nice and extremely helpful. I'll cover the permit scene later.

- **I don't have any tools and it must be expensive to buy everything needed to do the job.**

You will need many different kinds of tools, but they aren't that expensive and you don't need to get them all at once. There are however some very important tools that you will use in almost every phase of construction. Your total price for tools shouldn't be much over $1,000. You'll want to be sure that the tools you use a lot be of good quality. Among these are: tape measure, drill, circular saw, hammer, square, level, and a tool belt. The other tools you can get as you need them and you don't have to go for quality every time.

You can also rent almost every more expensive tool there is. Renting is a better way to go if you'll just be using the tool for a short time. I spent way too much on tools. I bought a Radial arm saw for $400, an air compressor for $300 and several other things that I used for a little while, but then was just tools in my way that cluttered the floors. So you really don't need to go out and get that much stuff. It's always good though, to have tools after your house is built because once you get started building, you seem to get building fever.

A person told me once that by the time you buy all the tools to build your own house you'll have shelled out enough money to hire a carpenter to do the work for you. I'm so glad I didn't believe that person.

- **I'll just rent it's cheaper.**

Renting is great as long as you're the landlord and not the tenant. I know very well that when a person is trying to get started after leaving the nest, it's almost impossible to build instead of rent. That's just fine. I think most of us have been there. You cut the apron strings and you're free to do what you want. You have aspirations of what you're going to become and visions of a great life full of abundance occupy your mind. Renting is fine at this point. There does come a time however; when renting is just throwing your money away. While it's true that renters don't pay property taxes, they do miss out on some good tax breaks and they aren't accumulating any equity in valuable property. If a person rents, that person is accumulating equity for the owner of the property or helping him to line his pockets.

Homeowners know that mortgage interest gives a substantial break come tax time. While we're on that note, I'm reminded of something said to me during one of my many conversations about doing all my own carpentry work. This person has a smaller home than I do, but his payments are much higher because he bought a ready-made home in a subdivision. He said, "I think it's stupid to build your own house because if your payments are low, then you don't get as good a tax write-off." This guy was serious.

You know, it's not good to judge people, we do however; have to attempt to assess everyone's level of understanding that we talk with. That's part of communication. When I run across a person that says something so absurd, I automatically knock about twenty-five points or more off what I suppose his I.Q. must be.

Now, we've established the fact that paying mortgage interest is evil, but most of us have to do it. Renting, in my opinion is worse because a renter throws all his money away, a homeowner only throws the mortgage interest away. Unfortunately, we know that the hard-earned money that is paid in mortgage interest goes mostly to those who need it the least.

- **My workmanship is so lousy, my house would probably fall down, even if it didn't fall down, it would look like a dump.**

Well, I thought the same thing because everything I had built up to that point did look like a dump. I was raised in the country on a farm. When something broke down, we could usually fix it with bailing twine or duct tape. My childhood was a wonderful time. I spent a lot of my younger years building tree houses and forts out of what wood and nails we could scrounge. All my work looked bad, even for a child my projects came out looking shoddy at best. I won the ugly car contest at a scouting pinewood derby when I was young. I even tried my best to make a good car. It didn't even go down the track because the wheels were so crooked. That's tough on an eight year old. I know I've got some deep emotional scars somewhere from that night.

But the work was always my own. I have always been independent. My work is my character signature. It represents who I am. It tells my story. The design of my house describes my personality. I always say, “Function over form”, which is a fancy way of saying, “My projects might look bad, but they work just fine.” Check out the photo.

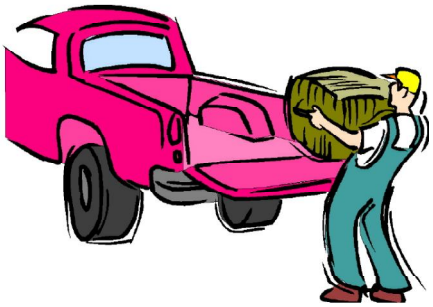
My first building project was this rustic log cabin where my brother and I cut down the trees for logs and drug them to the site with a pickup. We notched them with a chainsaw and an ax, then nailed them together with ring-shank spikes. Total cost was about $1100. It was a fun place for a couple of Mountain Men. Not much to look at though.

The real beauty of building a house even though you’re an amateur is that you start with the rough work. Rough work can be rough looking. A first time homebuilder can get away with some imperfections. You’ll find out that it only takes a short time to get your confidence, and some experience. The rough work all gets covered up by finish work. By the time you get to the finish work, you’ll have a lot of experience and your work will look good. Mine did.

Another thing is that right from the get-go; most homebuilders do their best quality work because it’s a home. It’s going to be around for a long time so it needs to be done right. Not only that, but when you’re spending so much money on something, you want it to look the best it can. You should keep in mind that you’re trying to make something valuable, something attractive not only to friends and neighbors, but also to appraisers and future prospective buyers.

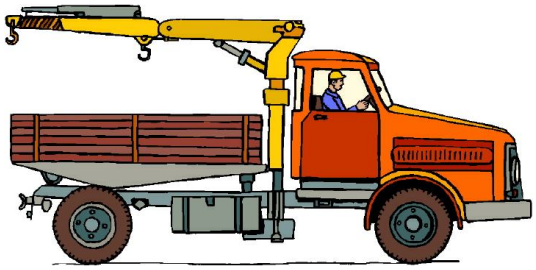
I really surprised myself (and probably everyone else,) when I was finished with the vinyl siding, how beautiful my house looked. With all the wonderful sidings and trimmings to finish a home with, your ugly duckling house will emerge a beautiful swan almost overnight.

- **I don't have a pickup truck to haul all the materials.**



Hey, I didn't own a pickup truck the whole time I was working on my house. I wanted one, but there just wasn't enough money for one. My brothers owned pickups, but I hardly ever borrowed them because the stores that sell building materials will deliver to your site.

I live 16 miles from the store where I bought most of my products. They would usually charge me $15 per delivery. That was a great deal because it usually cost that much for gas to drive and pick up materials. Not only that, but you also don't have to load and unload all the stuff. The only problem is that you can't hand select the materials and some stores will try to pawn off all the leftovers that others have picked through. I was very pleased the whole time with one particular store and I bought almost my entire house there. They even gave me a contractor's discount of 15%. I didn't even ask for it. They just wanted me as a customer. The prices were a lot lower at that store than the other. At the other store, they treated me really crappy and I am a nice person so I'm sure it wasn't my fault. I never darkened their doorway after that.



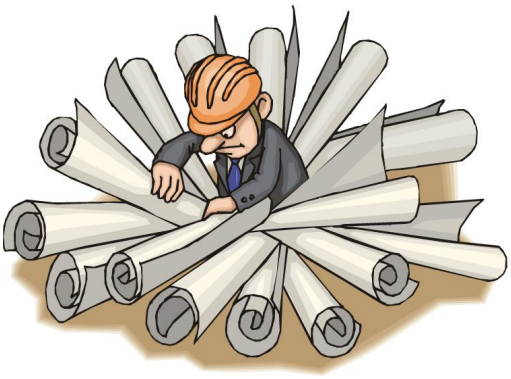
With a little planning, you can do the same thing I did and it will work out fine. Having a pickup is a definite advantage, but quite often a pickup won't even hold all the materials you're buying, so you'll have to have them delivered anyway.

- **I don't know anything about plumbing or electricity, I don't want to sleep in a house where I did the work, it might be a deathtrap.**

The fear of those things can be very real, yet I sleep well at night because of two things: Inspectors and local codes. Don't get me wrong; they are a real pain, that's for certain. Especially when you need them to approve some of your work so you can move on and they end up giving you a list of corrections to do. It's depressing and very frustrating, so you thank them for stopping by and watch them drive out of sight. Then you give them all the sign language you know, throw your fit, and then start working on the corrections they gave you.

I know that my house is as safe as any house around because the inspectors don't let you slide. Some codes, in my opinion, are overkill, but with most others, it's obvious why it came to be a code requirement. I know that I have done everything right because the inspectors took the time to explain it all to me. They could tell my work was that of a first time homebuilder. They were nice while telling me my work was substandard.

The first electrical inspector that came was a jovial chap. He looked at my work and just laughed. He almost hurt my feelings. It wasn't my fault; I bought a book about house wiring that was slightly out of date. It wasn't even close. That cost me a lot of time and money I didn't have.



When we moved into our home, I was completely confident that it was safe. I know the wiring is not going to melt or cause a fire. I know we won't be poisoned by methane gas or drowned by bad plumbing. I know my house won't fall down. Meeting code is not difficult if you know everything you need to know before you start putting things together. I don't remember the exact details of each inspection. All I know is it was a hassle, but I'd do it all again to be able to feel safe like I do.

- **I don't want the stress of doing all the work.**

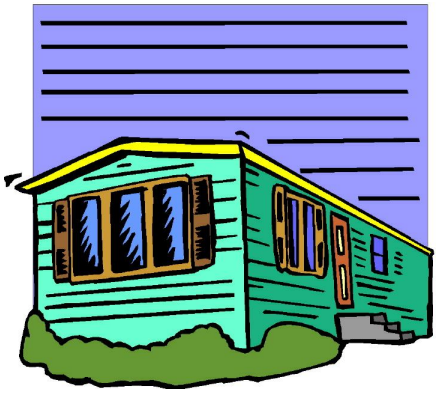
Certain parts of the building process are somewhat stressful. I understand how stress can be debilitating if not deadly. We all handle stress in a different way. I was unemployed most of the time while building my house. I was going to school to get vocational retraining so that was my work. Living on unemployment and trying to pay my bills was difficult. Also watching my half-finished house rotting away because I couldn't afford windows or doors was really stressful. The rain and snow was warping my floors and I couldn't do much about it.

It seems that the only stable thing in life anymore is instability. Constant instability is something we can count on. That's all the more reason why we need to create more equity in our property. If you lose your job and you have no equity in your house, you're going to have a rocky time. If you lose your job and you have a lot of equity, you'll have a few more options like selling the house and using the equity to move and buy another home where work is available. Or take out a second mortgage to live on and pay bills while you look for work. Some might say that you can't get a loan if you're unemployed, but if your property has high equity, you can get a loan somewhere and it will help you survive through rough times.

The codes and permits will be the most stressful of all. Actually working on the house is very therapeutic. Many, many times, I couldn't wait to get over to my house and start working so I could make the world go away. The best emotional strength builder you'll have is creating something beautiful by hard work. Your home will remain a symbol of your good character traits for years. You'll know it and others will know it too.

- **I can buy a Mobile Home for about half the price it takes to build my own house, I can have it right now and I don't have to work for it.**

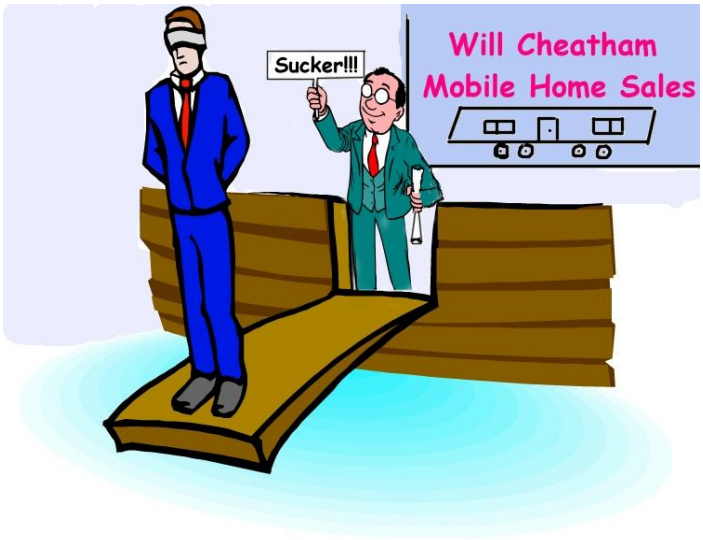
This seems to be the popular sentiment, given the amount of Mobile Homes everywhere. I know a few Mobile Home dealership owners that brag on the quality of their factory-made homes, but I don't know even one of them that actually live in the kind of homes they are so proud to sell to the public. They pull down big bucks so they can afford to live in better homes.



Here's one thing to remember: There's nothing natural about building a house and then moving it. By the time it arrives at its destination, it has probably had structural frame twists and many of the joints are no longer tight. That becomes evident a few years later if not immediately. I have worked a lot on Campers, RV's, Horse Trailers, and Mobile Homes, and even the fancier Mobile Homes are just a big Camper Trailer. They are built light so they can be transported easily and built cheap so the dealers can make a buck.

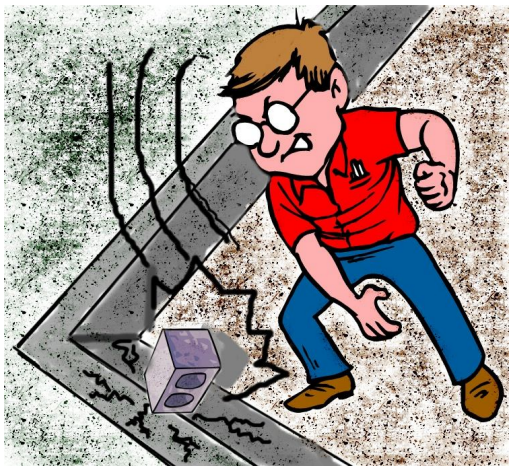
They don't age well so after making payments for 30 years, you have a not-so-mobile home that needs a lot of work. Not only that, if you build your own home, you'll spend much less than you would have spent and you'll have made a great investment. Frame homes that were built 30 years ago have appreciated by at least 300 percent and others over 1000 percent. Not too bad! Mobile homes don't have that kind of track record.

My wife and I were at one time considering a Mobile Home. They are fairly easy to buy and even people with low incomes can get one. I suppose many people have no other choice but to live in a Mobile Home. When we were looking at Mobile Homes, we went to a lot of places and the story was always the same.



The homes had a fairly modest price, but after all the hidden costs; the monthly payment was a whole bunch more than the advertised price. We have talked to a lot of people and they always say the same thing. They felt like they had been overcharged in the end, especially after seeing the low quality. The monthly payment was almost as high as a normal house. Many really felt cheated. The price was always higher than they were told, and the quality was always less than they were told.

One more point here is that Mobile homes are equity thieves. That's right; they are like cars in that respect, only worse. We have all heard that to drive a new car off the lot will cause it to depreciate substantially. Why is that? Because even if you own it for a short time and you decide to sell it, it's a used car. If it has 1 mile on the odometer, but has had a previous owner that put that 1-mile on it, it's still a used car. Now, let's say you had a piece of land with the well and septic system worth $15,000. You worked hard to buy that chunk of land. You decide to buy a new doublewide Mobile home. The home costs $60,000 originally but after tax and setup, it is around $75,000. (That is a very real figure) Your property at that point with home and land might possibly be worth $80,000. Suddenly, you owe more on your home than it is actually worth. If you sold everything at that point, you would make enough to pay off your Mobile Home Mortgage and still have $5,000 dollars left over. But wait a minute; didn't you pay $15,000 for your land in the first place and only got $5,000 for it? Man, you got robbed.



Now you know what Real Estate Agents as well as Mobile Home Dealers already know so well. Also, if you sell your Mobile Home, but choose to keep the land, there will probably be a sizable balance left to pay on the difference of what you paid for the home and what you were able to sell it for. In other words, you'll be making payments for years for an empty foundation. Many people have made that mistake and are still scratching their heads trying to figure out where their hard-earned money went after they sold their used Mobile Homes. They are equity thieves!

- **If building your own house is so great, why aren't more people doing it?**

That's a good question. I've wondered that for about the last ten years. I know when I was building my house I was very apprehensive about the whole thing. I remember thinking, "This can't be as good a deal as it seems. Soon I'll find out why more people don't do it." But you know what? That day never came. The project cost a little more than I had planned, but not much more. It was a lot of hard work, but it felt good to work hard on something I hoped would be a good thing. Now, after counseling others to do the same and seeing their success, the question is still unanswered.

I really don't have a good answer for that. I suppose it has something to do with people not knowing all the facts. People don't care about the facts because the thought of them putting on the tool belt and doing something so far beyond them doesn't even merit consideration in their minds. They are self-defeating and certainly don't consider themselves competent to undertake such a big project.

To those of us who dare to dream and actually do something to reach our dreams, the reward is there waiting for us. Rewards that are not only financial, but emotional as well. It is so satisfying to see a project through to the end and watch the appraisers actually put a dollar amount on your sweat equity. It was so amazing to me how much my hard work was worth. That equity is valuable to me as a homeowner.

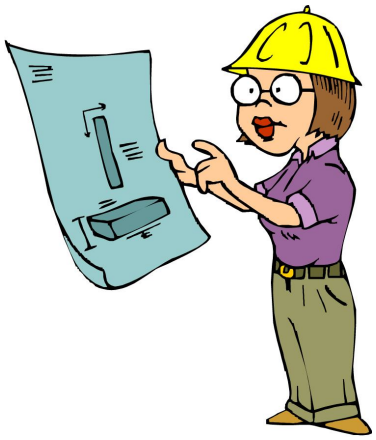
A few years before I built my house, I remember reading somewhere that if a person did all his or her own work instead of hiring it out, that person could save as much as 30% on the cost of the house. I thought to myself, "Man, that's not worth busting my hump just to save 30%." I asked my friend that had built his own house, if that was correct. He said, "That's hogwash, you'll save almost 2/3 the cost of the house if you do everything yourself." So, I went on faith and did my own construction and my numbers speak for themselves. It worked out that my savings came in at a little over 60%. That's really good equity.

"You'll save almost 2/3 the cost of the house if you do everything yourself."

- **Dealing with inspectors is too much of a pain; I hate it when other people tell me what I can or can't do.**

It's hard getting told what to do. I remember having a particularly mean teacher in school when I was in the sixth grade. Man, that teacher was pure evil. She had armor-piercing eyes and a nasty disposition. In this day, a teacher like that would be drawn and quartered by the parents or the superintendent the first day of class, but in those days, strict teachers that used a paddle were heroes to the parents. I think it was right around that time in my life that I developed a big dislike for authority. I'm cool with supervisors and foremen as long as they are doing what's right and are acting in the best interest of the company and the employee. I just really hate it when people tell me that I've screwed up and that's what inspectors get paid to do. They're nice about it though. One Electrical Inspector even told me, "I don't really care about rules and regulations; I just don't want you and your family to burn up." How can you argue with that?

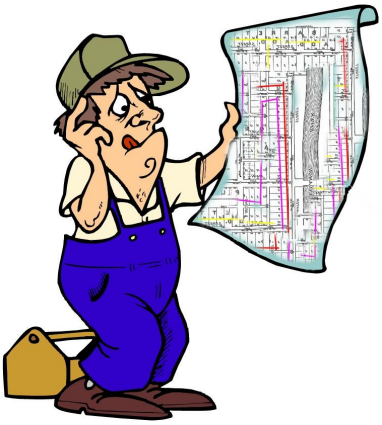
The subject of inspectors is one I've beat on too many times already. You can't argue with them because it won't get you anywhere. It's their plump rump on the line if something goes wrong with a new dwelling. We all hate being told what to do, but sometimes it's for our own good. I still think that teacher was evil though. No doubt about it.



- **You have to be smart to build a house.**

I'm a man of average intelligence (and that's a stretch). I know a lot of carpenters and tradesmen, but I don't think any of them design rockets for NASA or teach Astrophysics in the evening. Building a house doesn't take a lot of intelligence but you do have to have the ability to concentrate on what you're doing. Some of my biggest and costliest mistakes were made because I was thinking about other things. Making mistakes is all right as long as they're not mistakes that injure you.

When I'm doing work with a circular saw however; it gets my complete, undivided attention. You know, I used to work around all kinds of saws. Some were huge circular saws six feet in diameter. Others were double-edged band saws forty feet long and spinning at fourteen thousand RPM's. But the saws that I have the most respect for, is the circular saw or better known as the Skilsaw. Those bad boys are notorious for kickbacks. It's crucial that a carpenter concentrate on the task at hand.



Other than concentration, anybody can be a carpenter or tradesman. Even some of the more complicated electrical circuits can be figured out with a little concentration and common sense. Besides, you'll get a little smarter every day throughout the entire building process. It'll be good for you and you'll feel better about yourself too.

- **I don't know if I'm strong enough to do all the lifting**

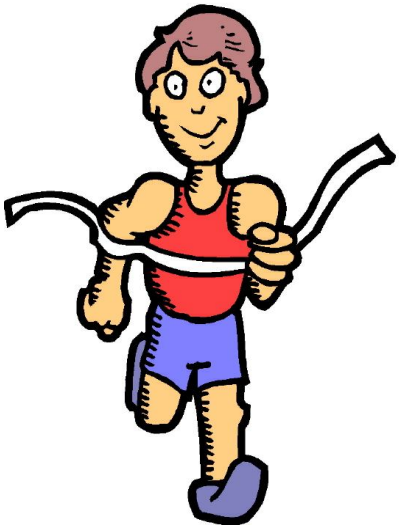
That is a very real concern. Through certain phases of the project, you will need to have a fair amount of strength. The heaviest materials will be the plywood or wafer board, the sheetrock, and the trusses will be heavy too. The walls won't be too heavy if built in eight-foot sections. If lifting is a problem, you can cut the sheets in half, but that creates a lot more work for you. It's just better to give it the heave ho and lob those fellas up in one piece. One note: if you're lugging up twelve-foot lengths of sheetrock, find a buddy!

- **I don't have anyone to help me.**

This problem has come up more times than you can imagine. I think the reason why is because building a home takes a lot of time. It's not something you can ask someone to help you do all the time. It's a long process and takes a high level of commitment. I have good friends, but I wouldn't ask any of them to help me after hours every day for the next year or so. That's only a favor you can ask family members to do. I was alone most of the time while building my house. It wasn't that my family or friends didn't like me. My father was there every day to help me.

His help was a combination of moral support and strength. But, I didn't need help all the time. The reason is because it was a one-person job most of the time. The thing is, most of the time I was doing things like running electrical circuits or putting ABS pipe together. One-person jobs. That will be the bulk of the time spent, so find yourself a good Walkman or MP3 player and some nice tunes and crank out brew!

There will definitely be times when you need a hand. If you're creative, you might be able to do it all by yourself, but for safety's sake, find some help doing the heavy stuff.



Well, that's it for all the "why" reasons you should build your own house. Now it's up to you to find the strength and endurance to get it done. Very few things in life that are worthwhile come easy or cheap. This is just one of those things.

We have all heard the saying, "You will get out of it what you put into it". But that's not even close to the truth as far as taking the time to build your own house. The truth is you will get much, much more out of it than you put into it and the small amount of hard work you do for just a year or two, will benefit you for the rest of your life.

Down the road, you will have forgotten all the hard work you had to do, but you will never forget how huge the advantages are of having high equity in your home, and low monthly payments. You will be reminded every month when you pay your mortgage payment and still have money left over for more important things. When you're able to retire early with a nice nest egg, you'll be glad you made the sacrifice earlier in life that enabled you to keep hundreds of thousands of dollars of your hard-earned money. Most people will spend roughly ten years of wages on mortgage interest alone. It doesn't have to be that way at all.

It's up to us to improve our situation in an unfair world. The world can sure beat us down at times, but we don't have to stay down.

PART 2

ONE

Getting your ideas and plans on paper

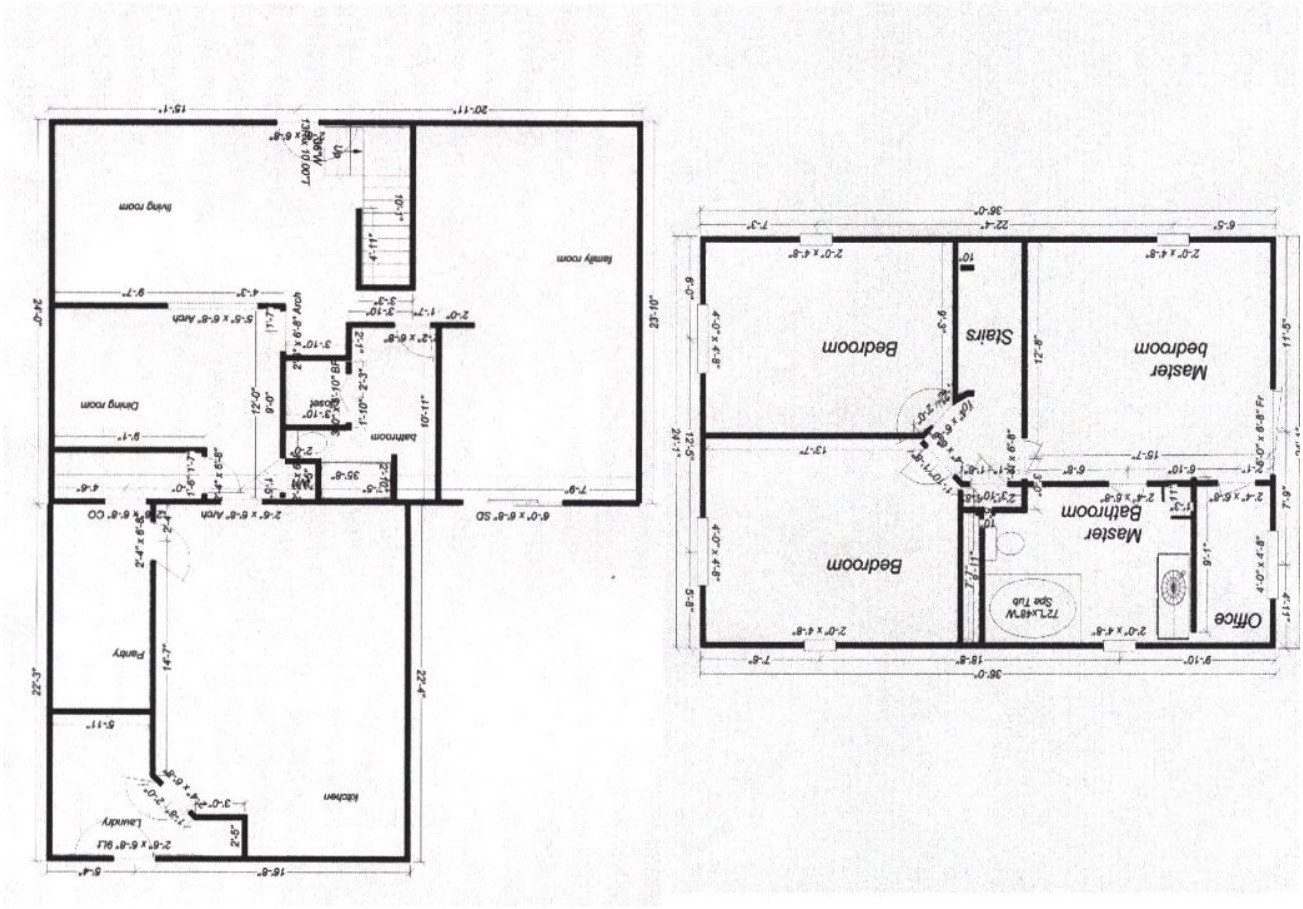
Before building your own house you need to make a good plan that involves important information. You need to consider first of all, how big you want to make the house, and second, how much money you can realistically spend. Most of the time, people are limited on the size they want because of the lack of capital they have. I was faced with the same thing. I decided to start out small and make the house expandable with future considerations in mind.

If you are a low-income wage earner, you may want to start out with something around 1500 square feet. You can roughly estimate that the cost per foot will be around $35. Thus, a 1500 sq. ft. home will average around $52,500. This depends on many different things of course. If you live in the city or the country, if you want fancy fixtures, or if you want expensive sidings and trimmings, then the cost can be substantially more. Suffice it to say, the base price for materials, is right around $35 per square foot.
The idea here is to find a way to have a nice home, when you otherwise wouldn't have a chance to buy a home outright because of low income. That is what I faced ten years ago and I still wouldn't have a nice home today if I hadn't taken a chance to improve my lifestyle against the odds.

The best thing to do while the idea is fresh in your head, is to go and buy graph paper, you know, the kind we used back in science. The paper has little grids that help keep everything to scale. When we made our first plans, we drew a big rectangle on the paper and every square was one foot. That helped us get an idea of how big we needed to make our house. Take a tape and measure just how big the rooms are where you are staying now so you have a comparison. Get it all down on paper to scale and even go to the appliance store to get the right measurements on all the appliances so you can plan the rooms. You'll need measurements on beds and dressers, desks and tables and all the things you will put in your house.

It will help you get a good idea of what you “need” instead of what you “want”, because sometimes our checkbook determines the difference between the two.

Our plans to begin with were relatively simple, but then we made several changes before we did our official blueprints. After making several adjustments, we ended up with this for our final design. It totaled right around 2100 square feet. See **Figure 1.1.**



Bottom Floor Top Floor

FIG. 1.1

We had a good plan because we did all the necessary research. The dimensions for all our appliances and cabinets were known before we started construction. We didn’t want to build a house that cost a lot more than we could afford. It was essential that we had the basics covered. Each person in the house needed a private room. Two bathrooms is not really a convenience anymore, it’s pretty much a necessity.

While bathrooms are somewhat expensive to build, there should be at least two regardless of the size of the home. A cozy family room is very important because most of the family time will be spent around the TV or computer. We didn't opt for too many extras in our house, yet we probably overspent to raise our comfort level a little. We put a large jetted bath upstairs for $1500, a gas fireplace for $2000, a dishwasher for $300, and the Redwood decks for $2500. Although we were on a modest budget, we did flip for these extras. They raised the house value by about $12,000, so it was definitely a good move.

At the time you're building, the last thing that's probably on your mind is the resale value of your house. This is one thing that should be considered before construction even begins. Your house needs to be attractive to buyers because the future is always so precarious. We don't ever know where we'll be a few years down the road. In other words, try not to build your house too unique. Unique is a matter of taste and the majority of homebuyers don't have the same taste. Just try to build something that has value and a few eye-catchers. If I was selling my house and some people came to look at it, I would bet the things that would stick out in their minds helping them to make the decision to buy, would be the jetted bath, the cozy looking fireplace, or the Redwood decks.

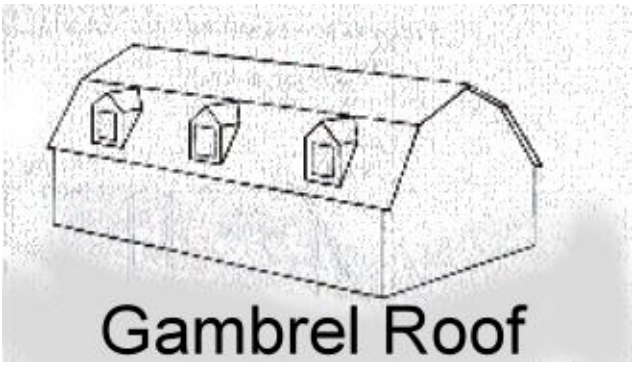


FIG. 1.2

The design of a Gambrel roof was the most economic because of the living space under the roof on the second floor as shown in **Figure 1.2.** We went with that style even though it wasn't really that attractive. If a person will put dormers on the side of the roof in a Gambrel (barn-shaped) house, it will make a world of difference in aesthetics. Also, it's nice having the windows to see out of. In the master bedroom, there is a window facing toward the East so we have a great view of the Grande Tetons. The sunrises in the East are spectacular. On the West and North windows we have a beautiful view of the Snake River. Typically, a house like this would not be a big seller because it looks like a barn, but our climate is quite cold and snowy, so people around here know that this type of house is easy and inexpensive to heat as well as strong under heavy snow loads. You definitely want to consider the climate when planning your home design.

There's just three more points to touch on before we get into the nitty-gritty of house building. Let's say you have your plans already done and you want to step off the measurements on your building site.

One thing that I have seen many times in my years of experience is when a homebuilder measures and marks the property it always seems smaller than it actually is. I mention this because this very thing has deceived a few aspiring builders. Here's what happens. The plans for a modest-sized home (say around 1500 sq. ft.), will seem depressingly small and some people will say to themselves,"forget it, this is too small. Let's just wait until we can afford to build a bigger house." This happens quite often and the dreams go unrealized. Look, I know it seems small, but once the walls are up, the house seems bigger. Once you get to the point where the walls are covered with sheetrock, you will get giddy and nothing will stop your progress after that.

The second point is that if you don't want to design your own house, you can buy ready made plans. This can help out in a few ways. Plans can be bought for around $50, and everything is professionally designed. They can be found in abundance on the Internet or in several kinds of house designer magazines. We're all different and some people might be looking for some ideas and inspiration. Either way, If you do the building yourself, you're my hero.

The third point is that if you overspend on land, you may never be able to build your house. I know a couple that did this very thing. Some riverfront property became available to them, but it was out of their price range. It was beautiful land so they bought it hoping to be able to build a house on it. The mortgage payments came each month and there just wasn't any money leftover to buy materials for a house. After a few years, their dream of building a home on that beautiful lot had to be let go. The property was sold and they pursued other options. It's a well-known fact that location has a lot to do with property value, but consider the goal we're trying to reach. We want to have a nice home with low monthly payments. If we were building mansions, then it would be different. We are however, only building homes that we as modest income earners can afford. A small or average-sized house is easy to resell if it comes to that. The buyer will probably be someone much like ourselves in circumstance.

A small house on an expensive piece of land won't sell very well. Maybe a rich person would buy it just for the land and destroy the house, but that is rare. It is far better to buy an affordable chunk of land and give it some tender loving care over the years. That will raise its value.

I built my house on a lot of ground we was using for part of a hayfield. Farmers grow hay when nothing else will grow. It has a lot of rocks, but we have done some great things with our land. The land was worth about $1,500 per acre as hayfield. Now it's worth close to $8,000 per acre as property surrounding a residential dwelling. Remember, buy it cheap and give it the TLC it needs. Your sweat equity will always reward you.

TWO

Those darn building codes and permits

Well, here we are at my least favorite part of home construction. Inspectors seem to be the necessary evils at the time of construction. I promise you as the years go by and your house hasn't fallen down, you'll be ecstatic that you jumped through all the hoops held up by the inspectors.

You will first have to take your plans to the building inspector. You can usually find the inspectors at your county courthouse or city government buildings. If you don't find them, they'll find you. It's preferable to find them before they find you in most cases. Anyway, you will be charged usually a percentage of the completed value of your home. This really varies so be aware. On average, building permits will cost around 1% the estimated value of the house. You'll definitely want to find out the actual percentage before you take your plans in. One way to look at it is regardless of who builds the house, the owner will have to shell out hard-earned bucks to the inspector no matter what. Not many ways out around that one.

The Building Inspector will need complete plans with elevation measurements and property descriptions. Duplicate plans may be required. Once you get approved, you will receive usually two copies of the permit, one copy to keep for your records and another to put at your building site to last through the entire construction project.

The Building Inspector will help you find the other inspectors for the Electrical, Plumbing, and Health codes. There may be other permits necessary depending on your city and county governments and the amount of needless bureaucrats sponging off the taxpayers. Don't worry, the permit fees for everything other than the Building Permit, are minimal.

I'll briefly cover the individual permits so an idea of what to expect can be established. It really helps knowing what you're up against. I sure wished somebody would have sat me down and prepped me on all the permits and codes, but I had to learn from experience.

It seemed like I had my knickers in a twist right from the get-go and it lasted the whole three years until the house was finished.

After the building permit is established, and all plumbing and electrical systems have been approved, a permit to begin plumbing and electrical will be issued. The Department of Health will need a sample of the soil if a septic system is needed to determine the length of a drain field. A description of the waterline, the septic line, and any irrigation waterways need to be evaluated.

The Electrical Inspector can be a big help before the project gets started. Any Electrical Codes such as the size of Service Panel or how many outlet receptacles are required on a wall can be obtained from the inspector. Ideally, the Electrical inspector will do an inspection just prior to the sheetrock, and then one after the home is completed. In a perfect world, inspectors wouldn't be very busy, but I really took a liking to my inspectors and had them come back several times. Also, you probably will need a temporary power hook-up from the local electric company. They will install a power pole and transformer with a couple of outlets to get you by until your Service Panel is finished and approved by the inspector. Then you'll get some real power!

The plumbing Inspector will grace your humble abode a few times as well. After the plumbing runs are finished, but before the fixtures are installed, you will be required to do pressure tests on both water lines and waste lines. In many areas, the water supply lines are tested simply by turning on the water and checking for leaks. In other areas the water lines are tested with air. The air PSI is usually much higher than normal water PSI. Water lines will have around 40-60 lbs PSI of water. The air test is usually double the PSI of water.

The test for waste lines which includes drain, waste, and vent lines is a much lower air PSI than water lines. You cap all the lines off at the fixture stub-outs with test caps or test balloons, then with a test pump put 5 lbs of air in the lines. It needs to stay at that pressure for about 20 minutes. You probably want to test the lines before the sheetrock goes in. If you do have a leak, you will probably hear it, but if your hearing is like mine, you can use a bottle of dish soap and a paintbrush or steal a bottle of bubbles from your kids. If you goop it on the pipe joints sometimes you can see what you're missing.

That's pretty much it for the permits and inspectors. Just remember, it's a hassle and it can be frustrating, but persevere to the end, it's worth it.

THREE

Time to get dirty, starting the foundation

You want to mark off the land and stake it out. You'll need to have an idea where to start digging. Make the measurements of the actual foundation and mark them. You can use wooden stakes and plastic ribbon or even kite string. Then plan for a buffer area about 2 feet all the way around the foundation for convenience of setting up forms and for backfill when the house is completed.

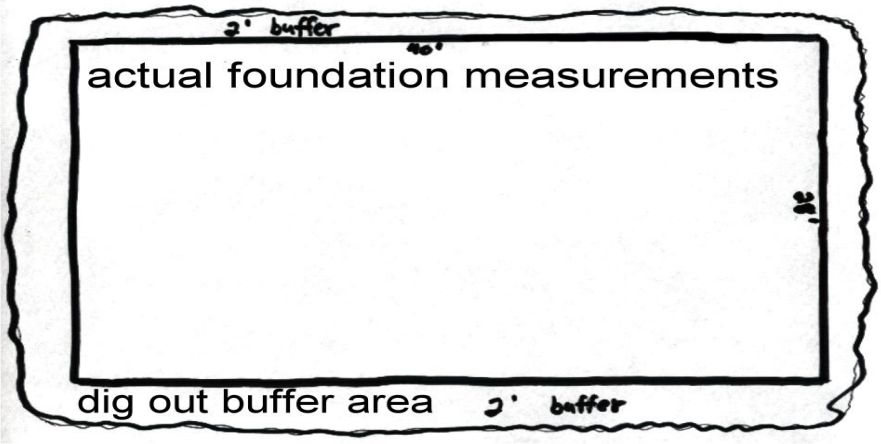


FIG. 3-1

You can choose the method for which you want to dig out your foundation. I used a pick and shovel. (Mostly a pick) That way can get really tiresome, so I suggest you rent or hire a backhoe. This also depends on the type of soil you have and the depth you need to reach to get below the frost line. If you live in tropical conditions with rich, not too rocky soil, heck, use a shovel and a wheelbarrow.

Most likely though, you probably live in an area where the rocks grow faster than the weeds do.

Your Building Inspector will help you determine the depth of the frost line. That tells you how deep to dig the footings and what dimensions they need to be. Usually, the footings will need to be 12 inches below the frost line. Inside the footings, you'll need to have some rebar reinforcements. 5/8" rebar is plenty strong. You will use two or three rods inside the footings and the rods need to be no closer than 3" from the outside of the footings wall. **Figure 3-2** shows size and thickness ratio examples.

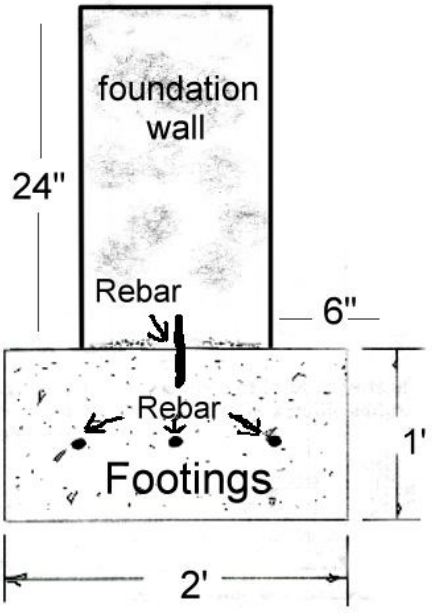


FIG. 3-2

This gives a good idea about the dimensions and how to put the rebar in so it gets completely covered. You can also use "rebar chairs which is a little wire frame to hold the rebar in place.

The forms for the footings will need to be in square. If you don't get this part perfect or really close, you'll be cussing yourself throughout the entire project. There are a few ways to make sure everything is square.

If you have a huge carpenters square, then that will do, but if you don't, like the rest of us, then a real good way is to do a diagonal measurement from corner to corner as shown in **Figure 3-3.**

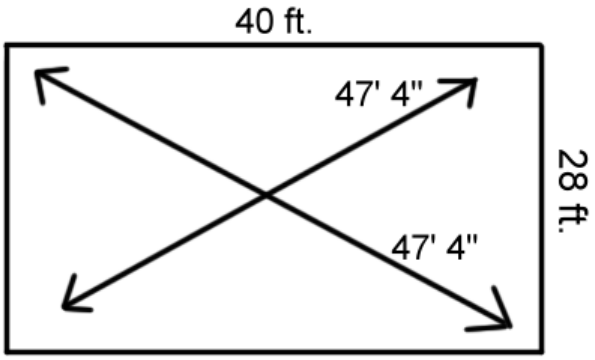


FIG. 3.3

Make sure the diagonal measurement is the same to the exact fraction of an inch. Another way to ensure that the forms are in square is by using 90° angles as shown in **Figure 3-4.** Learning to use 90° angles is a good idea anyway because it helps with other areas of construction.

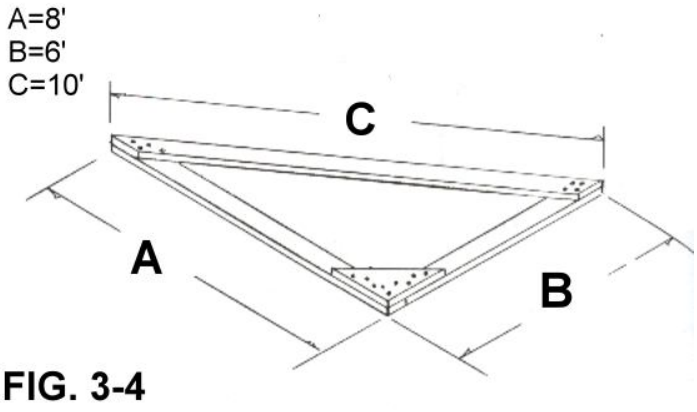


FIG. 3-4

After you get a good square measurement on the outside of the footings form, start the inside and measure the width of the footing.

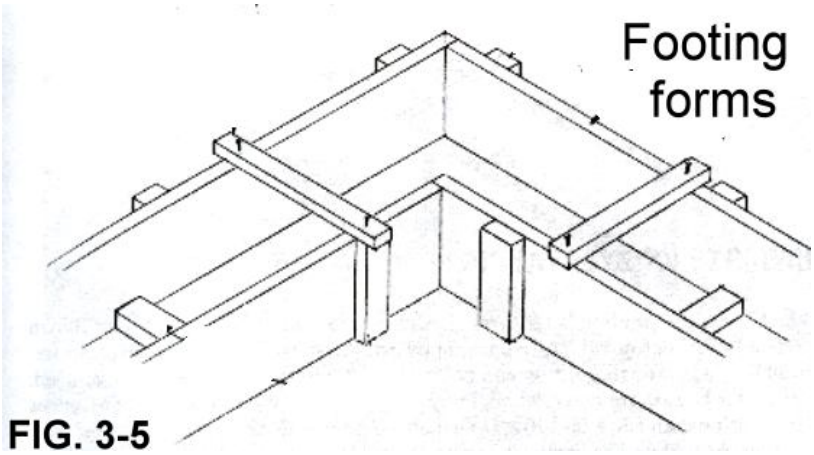


FIG. 3-5

After you get the inside form complete, brace the outside and inside forms together with strong, but removable braces as shown in **Figure 3-5**. Check once again, the diagonal measurement to make sure it's still in square. Then use wooden spikes to hold the forms in place because the heavy cement can bow the forms out if not braced properly. Next you can set up the rebar. The amount and size of rebar depends on your local building code. Areas where there is a lot of earthquake activity will require more and probably thicker rebar.

Here are a few examples how to join rebar and use it around corners. Check out **Figure 3-6**.

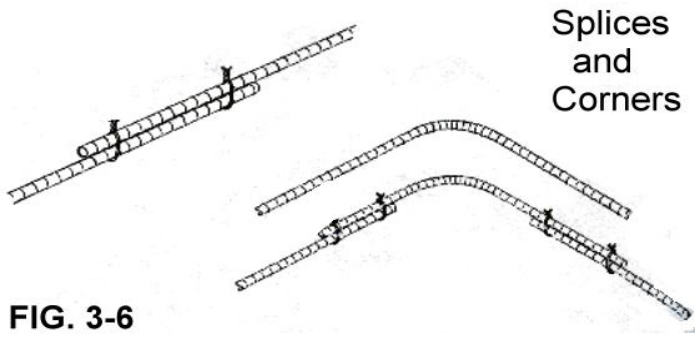


FIG. 3-6

Any place you have rebar that crosses, be sure to tie it up with wire so the cement doesn't force it apart. See **Figure 3-7**.

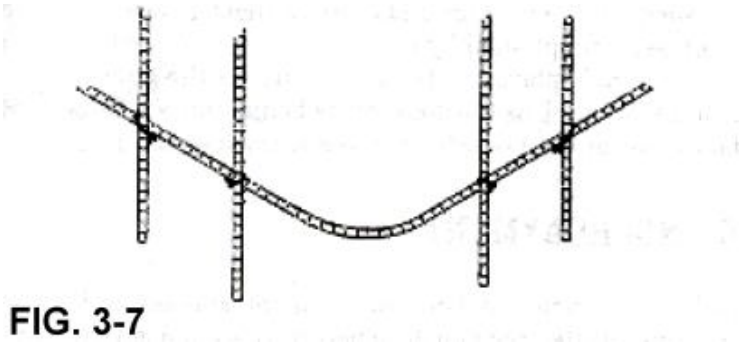


FIG. 3-7

Also a very important part of the footings is the key or the rebar connector that holds the foundation wall onto the footings itself. Pressing a beveled 2x4 into the freshly poured cement while it's being leveled can make the key. You can also run rebar that sticks up about 4 inches out of the footings every 2 feet or so. See **Figure 3-8**.

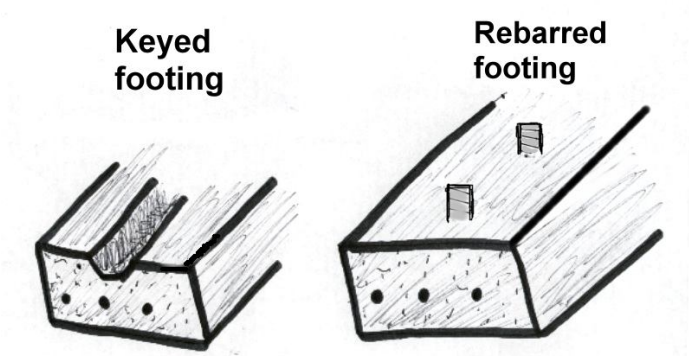


FIG. 3-8

You will have to pour the footings and the foundation wall separately to let the footings cure. I would wait at least one week between the two. Besides, construction of the forms for the foundation can start just a few days after the footings are poured.
Now, the foundation wall obviously goes on top of the footings. The building codes will determine its height. The codes will also determine the thickness requirements of the foundation wall. I went with an 8" thick foundation. There are several ways to set up the forms.

Here are two ways with the first being supported with form studs and braces as in **Figure 3-9**.

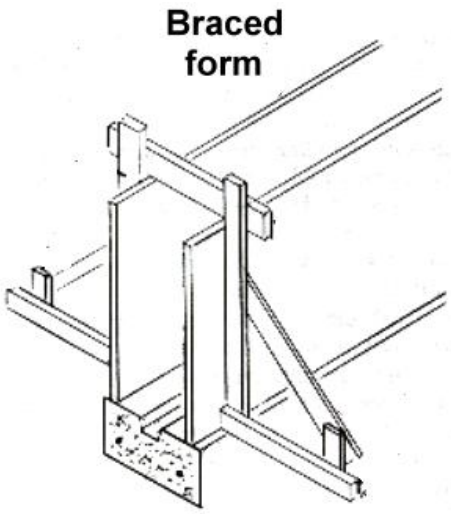


FIG. 3-9

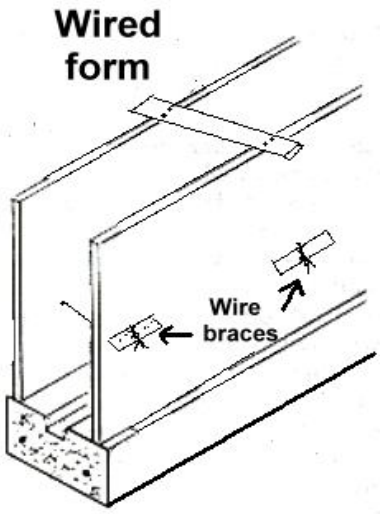


FIG. 3-10

In **Figure 3-10**, we see how to use wire by drilling small holes in the boards or plywood, running wires through and twisting them around wood pieces. Once the cement is hard, you can cut the wires or even break them off with a hammer so you can release the forms.

Now the things that actually hold the house to the foundation are the anchor bolts as shown in **Figure 3-11**.

FIG. 3-11

Gravity does a pretty good job holding the house on its foundation, but in unusually high winds, poorly fastened houses have been blown off their foundations. If you forget to put the anchor bolts in the wet cement, you'll hate yourself for a week. While the foundation wall forms are in place and before the cement is poured, mark where the bolts will be

placed. Usually, they will need to be placed 4' to 6' on center.
You can fudge them an inch or two either way to avoid putting them where a joist will be. **Figure 3-12**

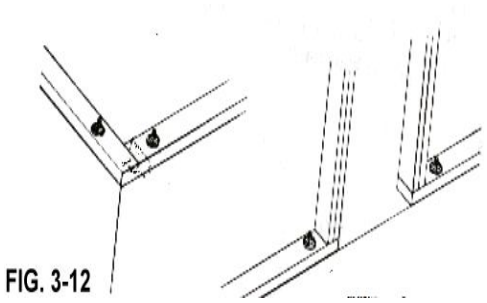


FIG. 3-12

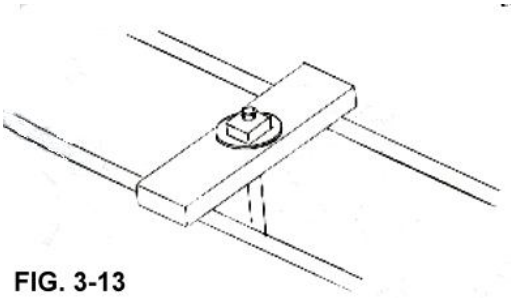


FIG. 3-13

Also, it's a good idea to hang the anchors using a piece of 2x4 because the board is the same thickness that your sill plate will be as shown in **Figure 3-13**. Try to plan ahead before laying out the spacing of the anchor bolts so you don't put one where a joist will be because the floor joists will rest upon the sill plate. Check out **Figure 3-14**.

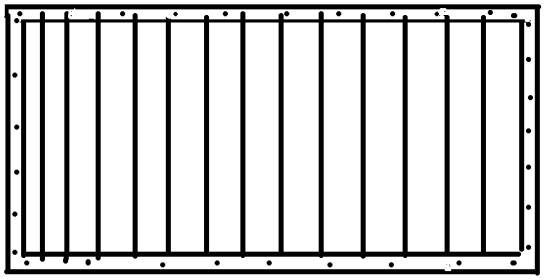


FIG. 3-14

By the way, making your own cement isn't a very practical idea. Have it delivered and poured by the local cement companies. Have a shovel to settle the cement into all the forms so no air pockets remain. You can use a flat board as a screed to make a smooth surface so the sill plate rests evenly on the foundation.

Once the foundation is poured and has cured for a couple of days, you can remove the forms. Be sure that the cement doesn't freeze while setting up. Clean up the forms. Remember, you can save money by using the forms as part of the framing.

After the foundation was finished we put the sill plate on all the way around and bolted it down. We kept the old forms, which we used for the foundation cement work. We'll use them for the floor joists to save money. It's kind of hard to see with all the snow. It slows down the work progress at times, but at least you don't get too sweaty!

FOUR

Framing and rough work

Now we're cruising! The framing and rough work are a lot of fun and you will see the house starting to take shape. It's at this point where you will see great results with a small amount of effort. This is also the point where you will start gaining valuable knowledge and experience about carpentry.

Now that the foundation is complete, it's time to put on the sill plate. Remember the sill plate is what attaches the house to the foundation. It is a board that covers the top of the foundation so you have something to nail the floor joists to. It's also wise at this point to consider using pressure-treated lumber treated with a chemical (usually arsenic), to prevent termites from infesting your dwelling. This is typically a 2x6 for cement foundations and a 2x8 for block foundations. The trick is to get a good fit over the anchor bolts. You can make the anchor bolt holes larger than they need to be to get a good fit. Once the holes are drilled and the sill plate is resting on the foundation with the anchor bolts sticking through it, you will fasten them down with heavy washers and nuts. Tighten them down really well while at the same time making sure that the plate is in square with the foundation wall. Also, the plate needs to be level. See **Figure 4-1.**

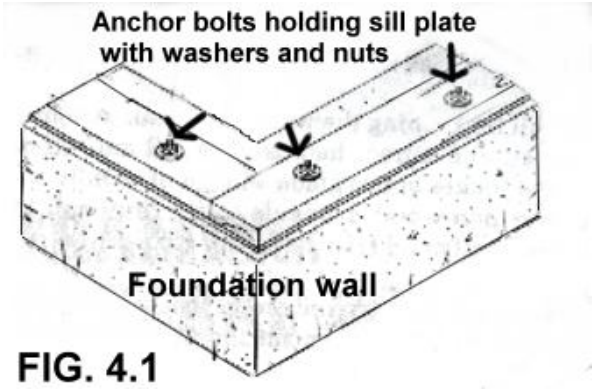


FIG. 4.1

Tighten down the anchor bolts evenly all the way around the foundation to prevent binding which will make an uneven surface.

Once the sill plate is on you can start to put on the rim joist. If you live in an area where there are termites, you'll probably want to use arsenic-treated lumber for the sill plate.

Now, you will make the Rim joist using 2x10's. They will rest on the sill plate. See **Figure 4.2.**

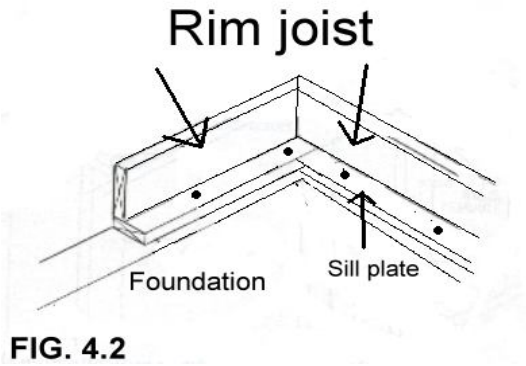


FIG. 4.2

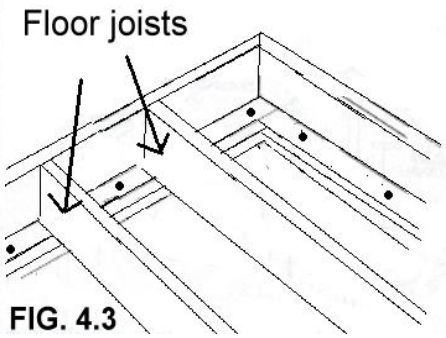


FIG. 4.3

The rim joist is the outside perimeter that the floor joists are attached to. The floor joists are easy to fasten down because you can nail them through the outside of the rim joist. You can use either 2x10's or I-joists for the floor joists.

Because most foundations are wider than boards are long, you will probably have to run a girder or girders up the middle to help support the joists. See **Figure 4.4.**

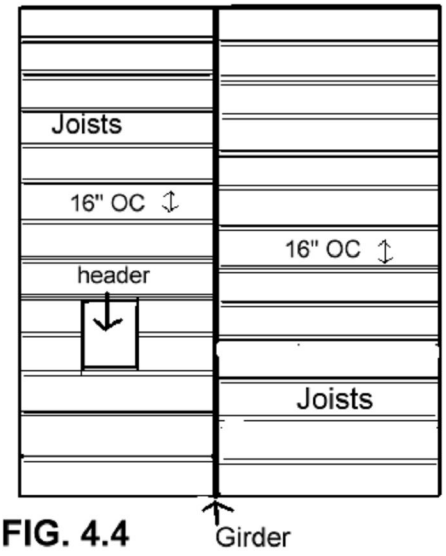


FIG. 4.4

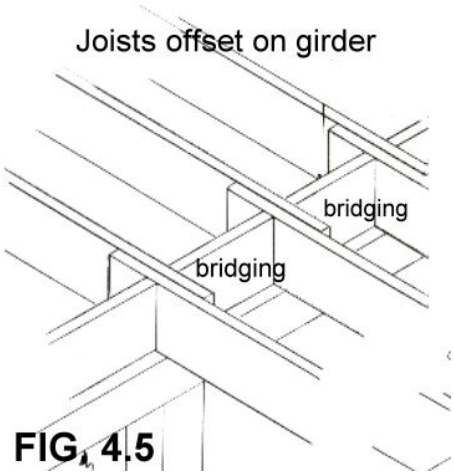


FIG. 4.5

It helps to offset the joists over the girder. You also need to add bridging between the joists for stability as well as fire blocking as seen in **figure 4.5**.

The girders can be made by nailing 2x10's together, just be sure to straddle the joints. See **Figure 4.6.** The post holding the girder can be a 4x4 on a cement pier or even a deck block. See **Figure 4.7**

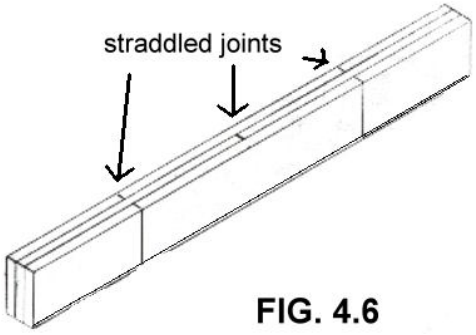


FIG. 4.6

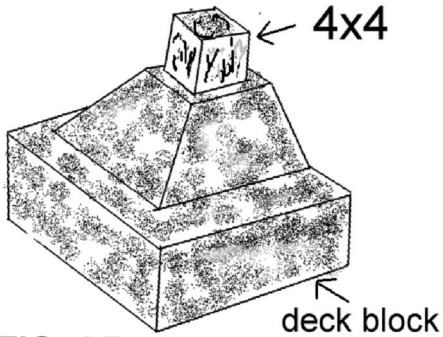


FIG. 4.7

The post or block needs to be on a footing though, so you will need to plan ahead when doing the foundation work.

Sometimes the 2X10's look a little ratty after they've been used for forms, but they work just fine.

While you have the floor open, now is a real good time to run some plumbing. The waste lines are 2 and 3-inch ABS pipes and are really difficult to put in once the floor is covered. You can put pipes through joists, but be careful not to weaken the joist. A reinforcement block should be put in. See **Figure 4.8**

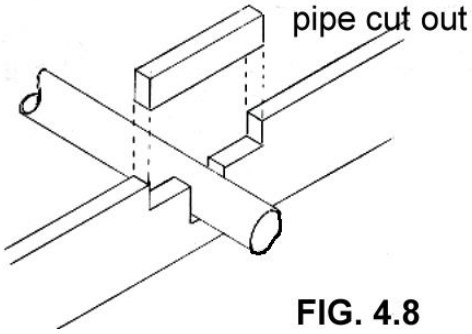


FIG. 4.8

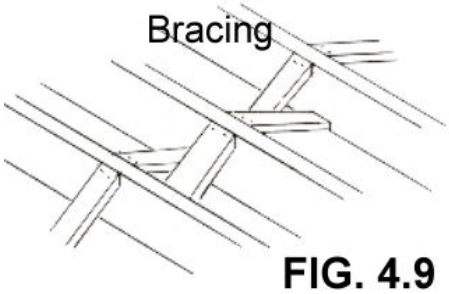


FIG. 4.9

As a final touch, you might want to brace the joists for more stability. It also helps reduce the chance of squeaky floors. See **Figure 4.9**

Now is also a good time to run water lines and even electrical wires under the floor along the joists. Remember, it's much easier to do it at this point than to be crawling around dragging your tools along with you in the dark.

Now the floor joists are ready for the sub-floor. This is where you find out why it's so important to have the foundation in square. You can use plywood or wafer-board (OSB) for the sub-floor. Many Carpenters like to use tongue-in-groove sheets because it has a better fit and the floor is less likely to squeak. The thickness of the plywood or wafer-board needs to be at least 5/8" thick. Start at any corner and lay the sheet down so it fits tightly into the corner. See **figure 4.10**. It will extend to the floor joists in even measurements if you use 16" centers or 24" centers. You can use 8d nails to fasten the sub-floor to the joists. Offset the plywood joints or straddle them for extra strength.

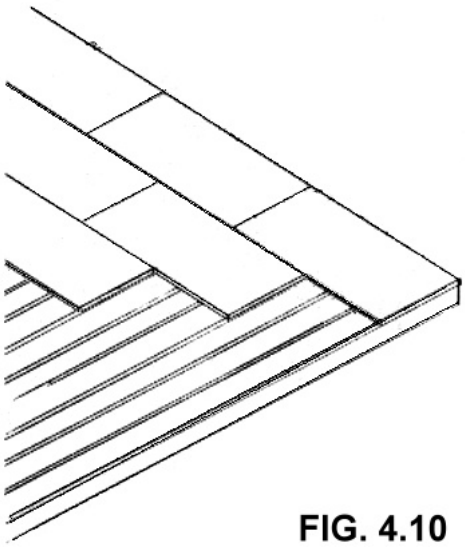


FIG. 4.10

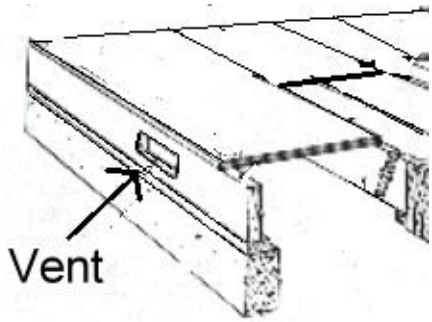
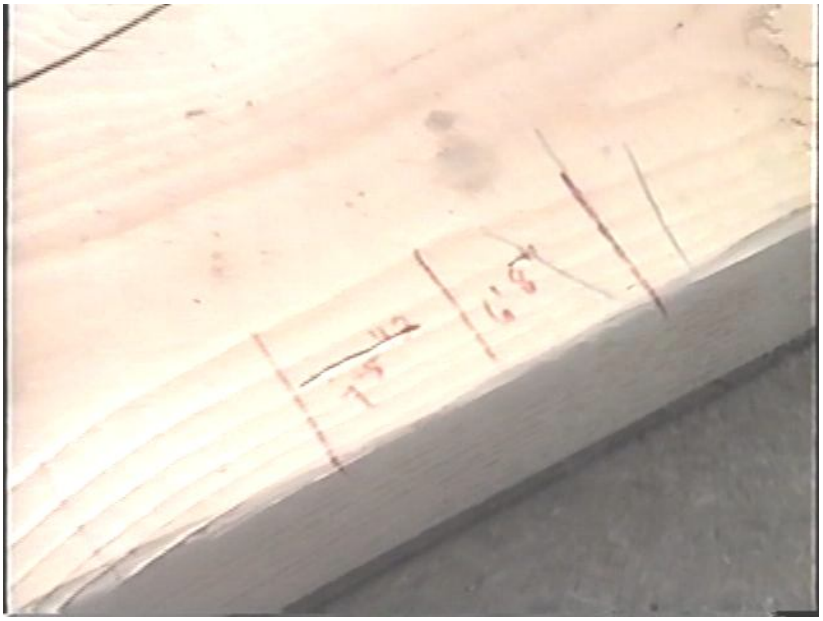


FIG. 4.11

You will also need to cut a vent hole in the rim joist about every 15' or so to increase airflow and prevent the joists and floor from rotting. See **figure 4.11**



Time to move on to the wall framing. At this point, your house starts to get its personality and you will start enjoying the entire project a whole lot more.

Some people will start by putting a sill plate down on the outside perimeter of the floor, and then mark it for studs and door openings. See **figure 4.12**

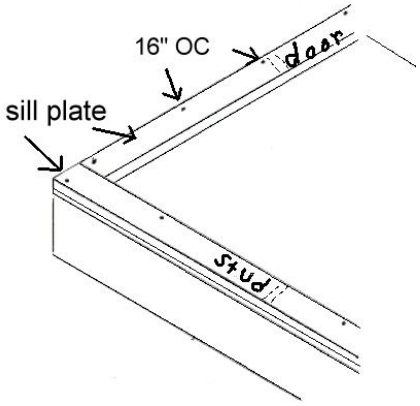


FIG. 4.12

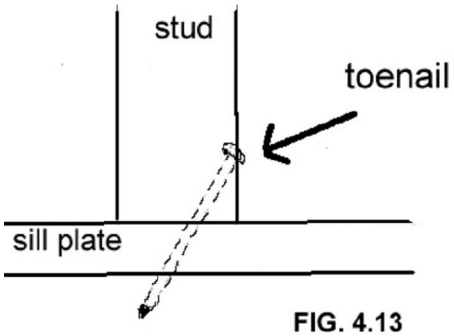
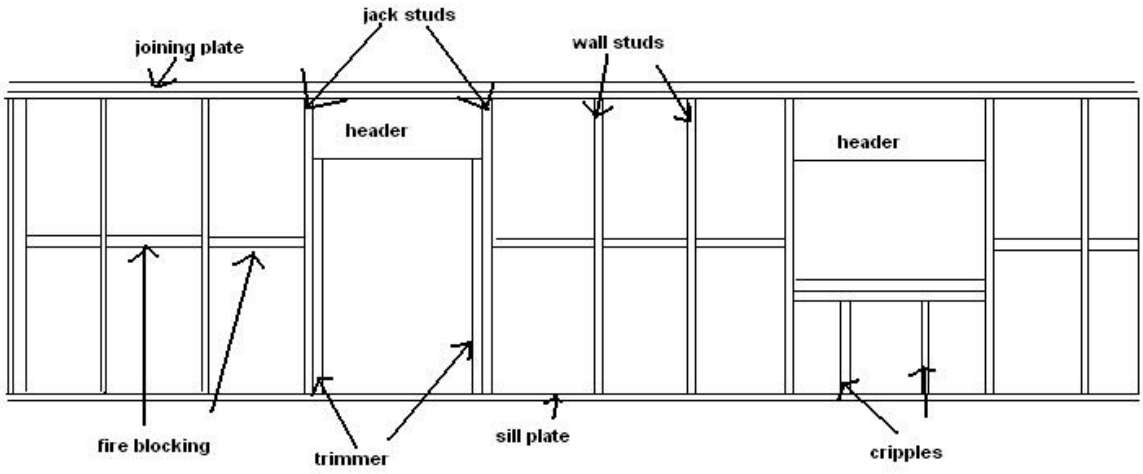


FIG. 4.13

If you opt to put the sill plate down first, then you will attach the wall studs by toenailing. See **Figure 4.13** Otherwise, you can pre-build the walls in 8 ft sections and stand them up and then nail them to the floor. You need to nail into a floor joist for strength. If you are using 2x6's for walls, then you will probably want to build in 8 ft sections because of the weight when standing them up. **Figure 4.14** shows a complete wall.

FIG. 4.14



When you build the walls, you will need to space the 2x4's on 16" centers. With 2x6 walls, you can probably get away with 2' centers. At the corners you will have to make a corner post. See **figure 4.15**. Where interior walls will attach to exterior walls, there will need to be a partition post. Corners need to be connected in a strong manner. Where there is a doorway or a window, a special form of bracing needs to be done. The jack studs act like regular wall studs. They help brace the trimmers and the headers. See **figure 4.14**. The door and window openings are called rough openings. You need to know the rough opening dimensions of doors and windows before you build the wall. See **figure 4.16**

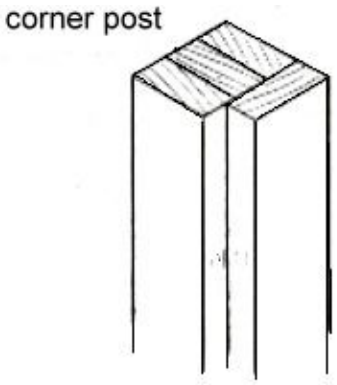


FIG. 4.15

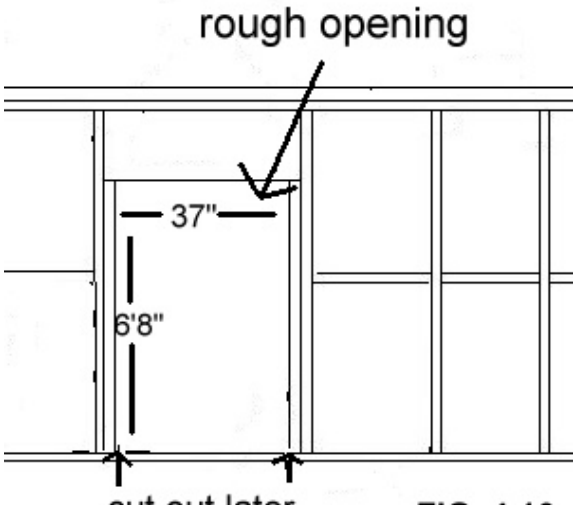


FIG. 4.16

You can get all the rough opening measurements where you get the doors and windows. The rough opening dimensions depend on the sizes of doors and windows you want although some sizes are pretty much standard for entry doors.

After you get the walls up, you will need to run a double plate on top to hold the sections together better. The same thing applies to the interior walls. See **figure 4.17**

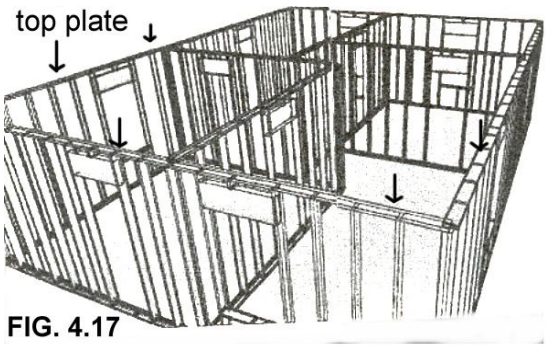


FIG. 4.17

A top plate all the way around the exterior wall will be a 2x4 or a 2x6 depending on the thickness of the wall. Most interiors are 2x4 studs so the top plate will be 2x4's. Make sure to offset the joints to maintain stability. See **figure 4.18**

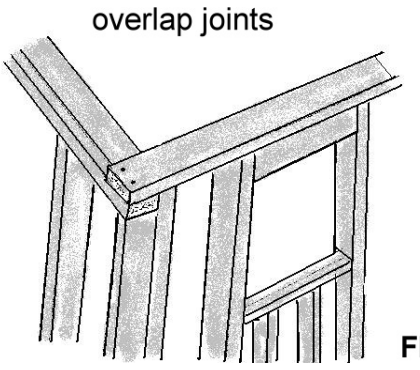


FIG.4.18

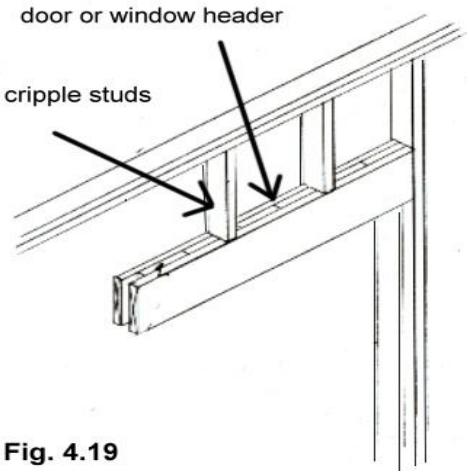


Fig. 4.19

Wherever you have a door or window, you will want to put a header to distribute the weight from the upper level to the floor. See **figure 4.19.** A 2x6 works well for headers as long as you have adequate support with the cripple studs.

This is how you overlap the joints for extra strength. This is necessary on interior walls. Interior walls and some outside walls will need to have pipes running through them. This substantially weakens the strength of the board so reinforcements will need to be made. **Figure 4.20** shows one way to reinforce a vent or waste pipe.

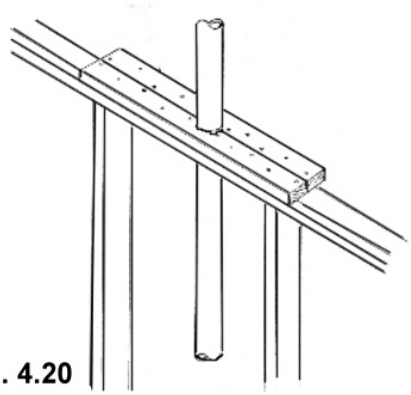


Fig. 4.20

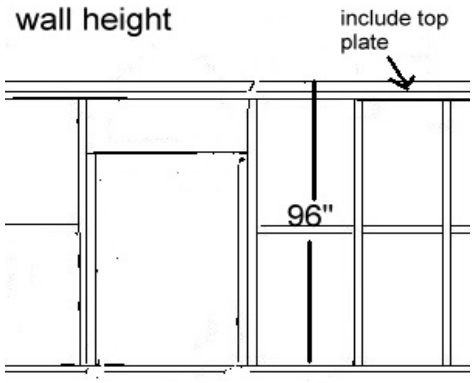


Fig. 4.21

The height of the walls is really up to the owner, but certain dimensions make for easier work. Back in the 70's, a ceiling height of 7'6" was quite common, but after that, trends went into different directions. A good measurement is an 8' ceiling. Whatever you decide, you need to remember to adjust your wall height to include the top plate. See **figure 4.21**. You can use builder studs that are already cut to the perfect height.

When you put each piece of wall up, there is a danger that it could still fall down or even get blown over by the wind. They are heavy and need to be braced until the outside sheathing is applied. **Figures 4.22** and **4.23** show how this is done.

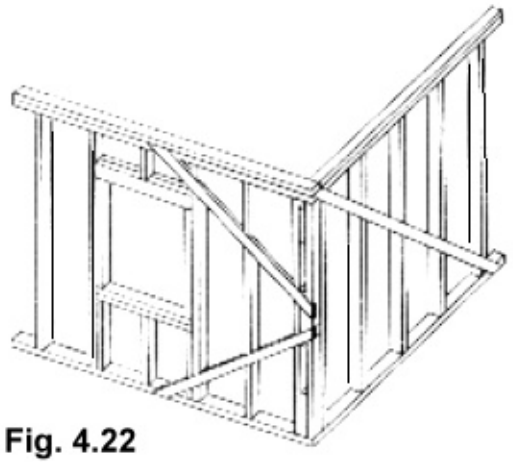


Fig. 4.22

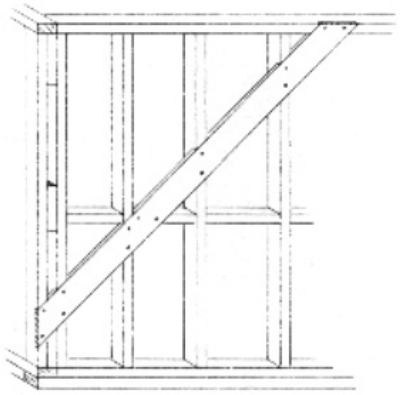


Fig. 4.23

Many contractors these days use framing anchors and hangers. These goodies help speed up the building process while actually making the joints stronger. The only problem is that they are very expensive if used consistently throughout the construction project. There is no harm in toenailing boards in place to save on costs. There are certain areas in your house where you'll definitely want to use anchors for greater strength. **Figure 4.24** shows some commonly used anchors and hangers.

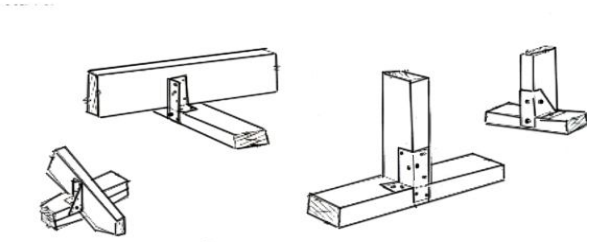


FIG. 4.24

Now that we have the walls up, it's time to either build a second floor for an upstairs, which is the same as building the first floor, or just put the roof trusses in place for a single story home. Let's work on the single story home by putting up the rafters.

Rafters and trusses can be made to save money so you don't need to buy prefabricated trusses at the high cost. They need to be strong and you should be generous with them because of the strength they offer.

There are several kinds depending on how you want your roof to look. The most common is the W-Type as in **figure 4.25**. It works very well and is easy to assemble. **Figure 4.26** shows different slopes for the trusses.

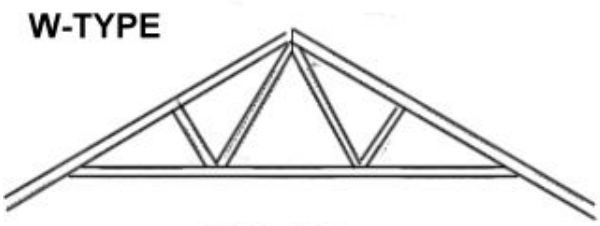


FIG 4.25

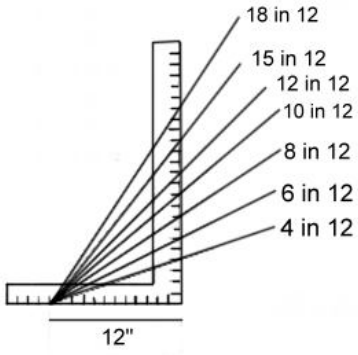


FIG. 4.26

Roof pitch is measured by how much slope is in a 12" measurement. A carpenter's square helps to find the angle. If you measure 4" up on the square and 12" over, you have a 4 in 12 pitch, which is really quite flat. A more common pitch is 6 in 12. That will make a stronger roof and it will shed water faster. Pitches higher than 8 in 12 are usually reserved for special house designs or for areas with very heavy snow and ice loads.

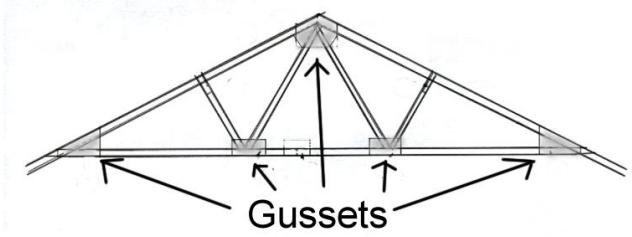


FIG. 4.27

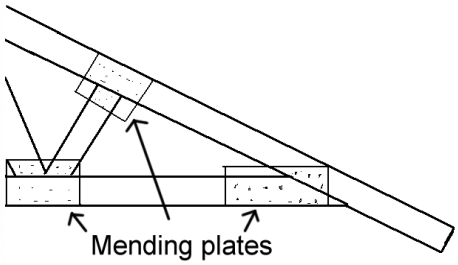


FIG. 4.28

When you build the trusses, you want to make them with only the best lumber. Make sure it is free of knots and cross wood grain.

You can use mending plates, which are metal plates that can be hammered or pressed over the joints, or plywood can also be used. See **figure 4.28**. The important thing is to make a strong truss at any cost. Both sides of the truss need to have these plates.

The trusses can be attached to the walls by resting the cross part of the truss called the collar beam onto the top plate of the wall. See **figure 4.29**.

The dimensions you want to build your trusses depends on the slope of the roof that you want, but the collar beam needs to be a perfect fit according to the measurement of your walls. See **figure 4.30**.

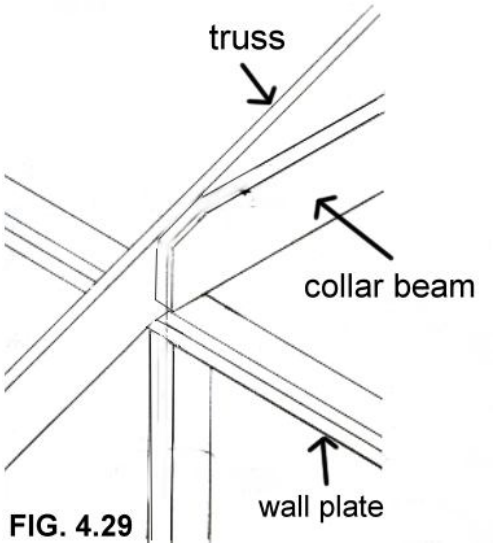


FIG. 4.29

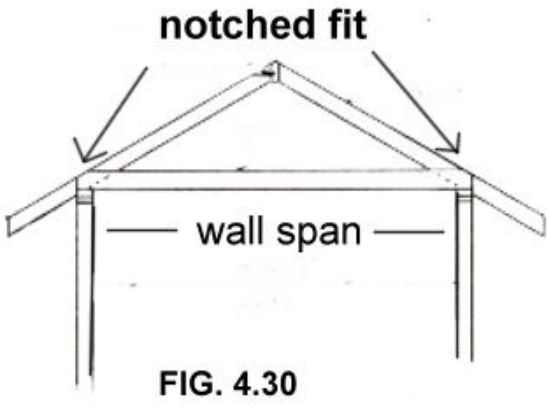


FIG. 4.30

There is a notched fit on top of the wall plate so the truss can extend beyond the wall about 16" to create the eave. Some call this angle cut a bird's mouth. It helps the truss fit tightly into place before it is nailed. See **figure 4.31**. You can fasten the truss by either toe nailing it in place or by using truss fasteners. See **figure 4.32**.

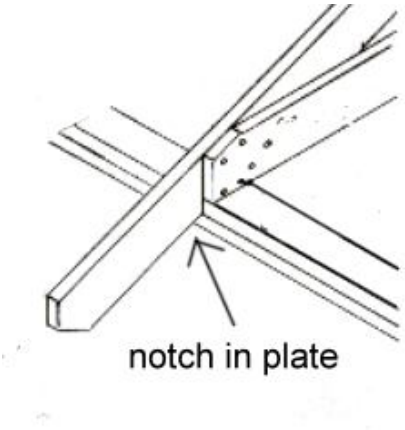


FIG. 4.31

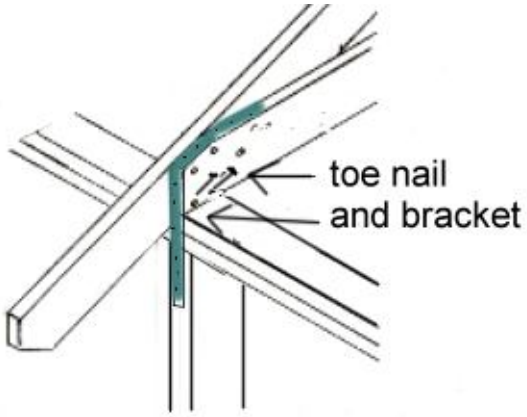


FIG. 4.32

I will also briefly cover another type of roof that is much more economical because of the increased living space it offers.

Gambrel type roofs are making a come back because they make so much sense. It is a barn shaped roof that has a lot of living space under it in the form of a loft or even an upstairs. If you think about it, you need to have a roof no matter what. So a gambrel house gives you a second floor and almost doubles your square footage, at about the same cost as a single floor home. Remember, an important part of the appraisal process of a home is how many square feet it has. It will usually be compared to similar homes in the neighbor hood with the same amount of square footage. A single floor home with the same amount of square footage as a Gambrel home, will be more expensive to build, yet will have about the same value. When I built my home, the decision was easy to make. I decided to go up, not out for extra square footage. See below.

Gambrel-roofed homes do have a few setbacks though. They are kind of ugly. They really do look like a barn and a lot of people take offense to “being raised in a barn”. The upstairs walls are also sloped and it is difficult to hang things on the walls. Dressers and cabinets need to be put on interior walls. That’s something to think about.

I have always preferred function over form and it has rewarded me well every single time. This style of house is just about as easy to build as a single floor house. The roof trusses are obviously very different from W-type trusses. In a Gambrel house, the roof pitch is a combination of two slopes at the pitch and at the knee. If a load-bearing wall runs up the middle to support the roof, a steeper slope can be used to provide a little more living space upstairs. If the upstairs is open with no partitions, then an angle of 90° between the two combined angles has to be made. This is a bit confusing but it is really quite easy to do.

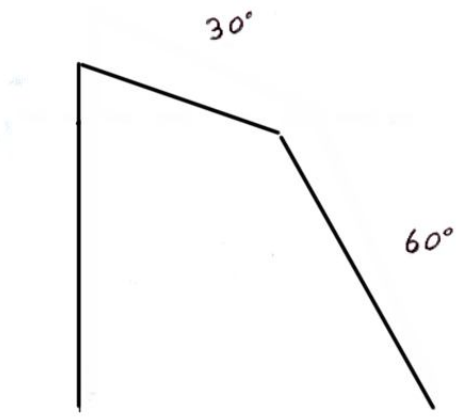


FIG. 4.33

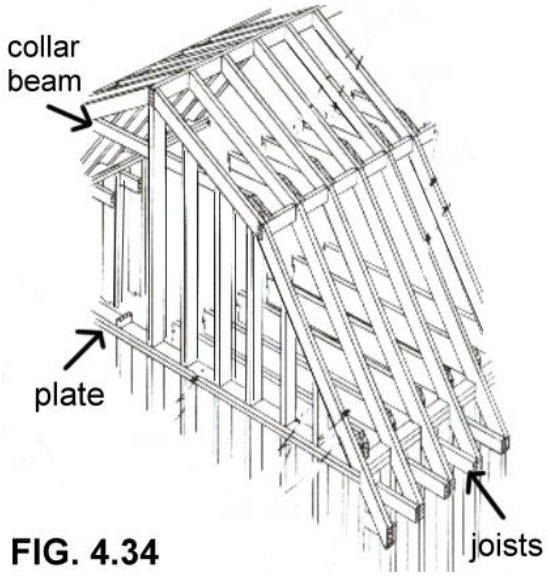


FIG. 4.34

As illustrated above, in **figure 4.33**, a 30/60 slope isn't difficult. It can just about be attained by guesswork alone. It is important to distribute the weight from the ridge to the knee. Also a collar beam will be necessary and it will help relieve pressure from the sides of the roof. Most gambrel houses have dormers to help improve the looks from the outside and to provide a view and sunlight on the inside.

Dormers are really quite necessary for gambrel roofs, otherwise things get kind of dark on the inside and it might seem rather cramped and stuffy. See **figure 4.35**.

FIG. 4.35

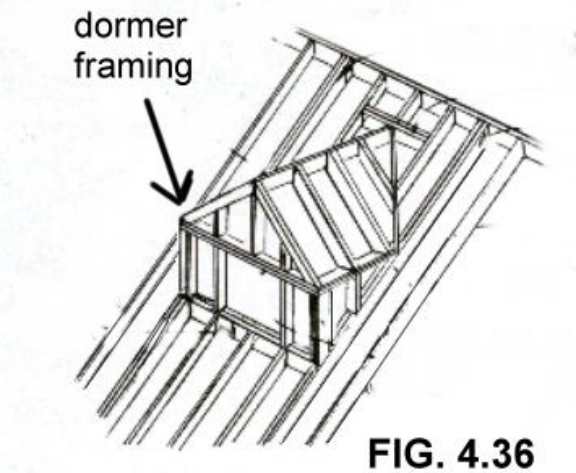


FIG. 4.36

Dormers can be attached to either the side or the top of the roof. The angles can get a little tricky but with a carpenters square and maybe even an angle finder, the job goes quickly and makes a big difference in the overall appearance of the house.

Here you have the inside view looking out at the dormer and the outside view looking in. Next, you'll need to do the gable end framing to enclose the roof and sides of the top floor.

Figure 4.37, gives a good idea of one way to frame gable ends.

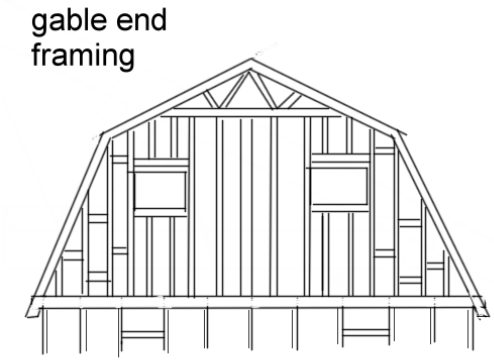


FIG. 4.37

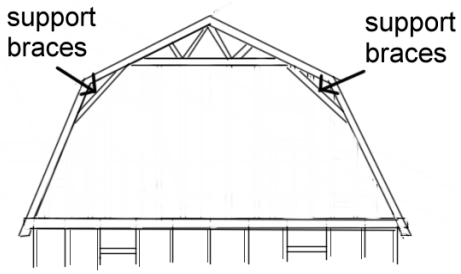


FIG. 4.38

In areas where heavy snow and ice form, a Gambrel roof is a good choice because of the strength. If you have any doubts, you might want to reinforce the knee with support braces. A simple 2x4 works just fine fastened with mending plates or plywood with small nails. See **figure 4.38**.

On the left, you can see the knee without reinforcements. On the right, the knees have been reinforced on each side with 2X6's. The angle on these knees are not within code because of the weak pitch; however this roof will have a dividing support wall to brace the rafters up bringing it into code.

There are several ways to make the eaves on gambrel roofs. I just attached them to the outside of the sheathing by using grabber screws from the inside. They are attached to 2X6's on the inside so they are strong. The roof sheathing also helps to keep them in place.

Now, let's get back to the normal type roofs that aren't gambrels. They will need a special kind of cornice to cover the ends of the trusses.

Next, let's frame in the cornices by either making extensions from joists and trusses or by building them separately and attaching them.

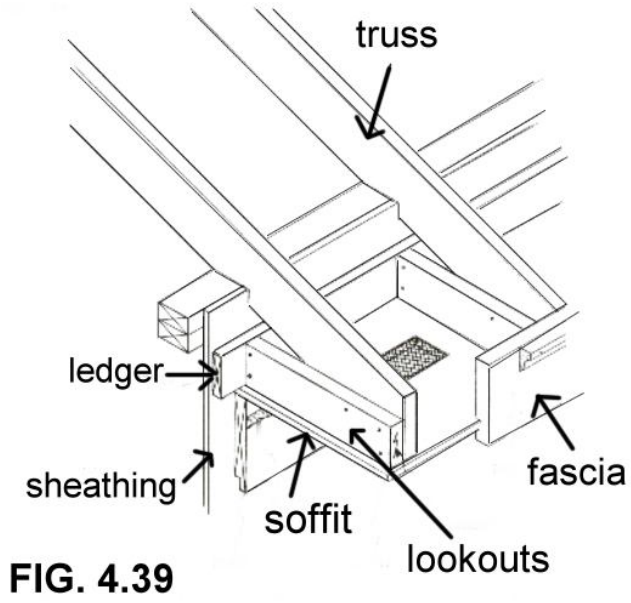


FIG. 4.39

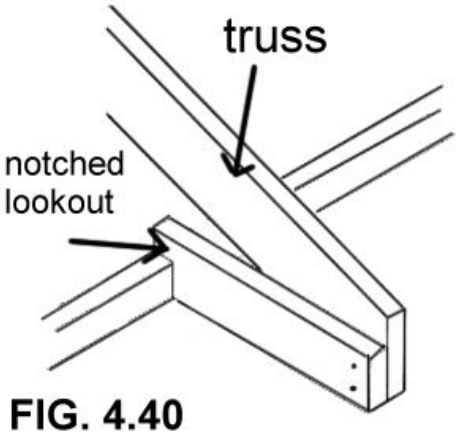


FIG. 4.40

As shown in **figure 4.39**, the cornice is framed in after the wall sheathing is finished, but before the roof sheathing is put on. A ledger is attached to the wall sheathing and runs the distance of the wall. A 2x4 works well for this.

Be sure to give the ledger some stability by nailing into wall studs and not just the sheathing. The lookout is a 2x4 cut to the measurement from the end of the truss to the ledger, then nailed to the truss and to the ledger. The soffit and fascia sheathing can then be applied. The soffit needs to have vents cut into it, which will be covered by a screen when the soffit sheathing is covered by a metal soffit covering. The fascia sheathing is the same as the soffit sheathing; it's just a plywood strip to cover the end of the trusses.

Figure 4.40 shows how to build the cornice as part of the framing before the walls get covered with sheathing. This is a more stable way of making cornices. Either way is just fine. Next, the gable end cornice has to be made. Extending lookouts from the gable end can do this. See **figure 4.41**.

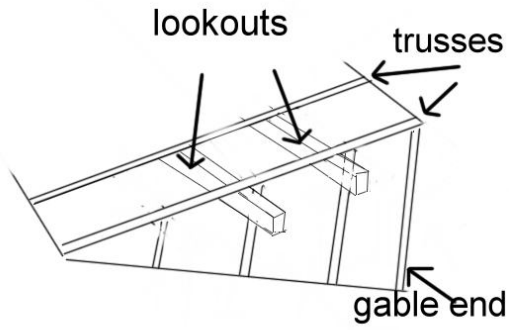


FIG. 4.41

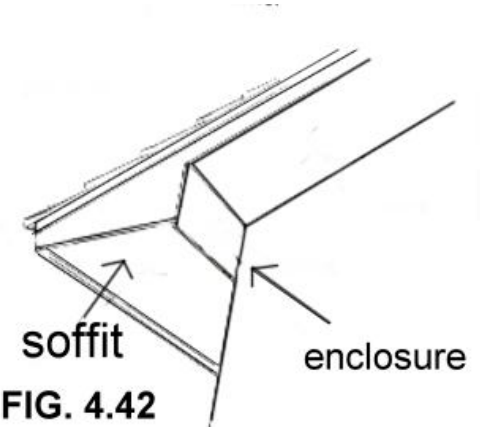


FIG. 4.42

Once the gable end cornices are framed in, you can then cover everything in sheathing. You can get a good idea from **figure 4.42**.

Just as a note of importance, if you choose to paint your house instead of using siding, you will want a good exterior grade of plywood to prevent swelling. There are some individuals in this day and age that still like to paint exterior surfaces. Painting involves high maintenance and continuous expenses. With the low-cost, high-quality sidings available these days, exterior painting is becoming a has been, but to each their own I say.

FIVE

Sheathing the outside and roof

Now that we have the framework done, we want to cover it with sheathing. There are several choices in sheathing. You can use plywood, wafer-board, or lumber siding. There are many other kinds of sheathing that are sheathing and siding combined, but in the interest of saving money, I suggest using plywood or wafer-board. Wafer-board is like plywood in the fact that it has several layers glued together. The difference is that wafer-board is made from chips and plywood is made from large timber. Wafer-board has a better future than plywood with all the tree-huggers in the world, so now is a good time to start using wafer-board. When I talk about wafer-board, I'm really referring to a product called OSB or Oriented-Strand-Board. It costs less than plywood and is at least as strong.

You will want to use at least ½" wafer-board. I prefer using 5/8" sheathing on the walls. The roof sheathing is the same provided the spacing of trusses is no more than 24" apart. On the walls, you will need to start at a corner and include the rim joist and sill plate as part of the wall being covered by sheathing. See **figure 5.1**.

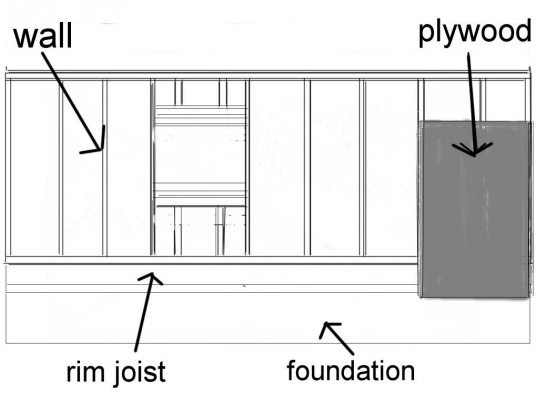


FIG. 5.1

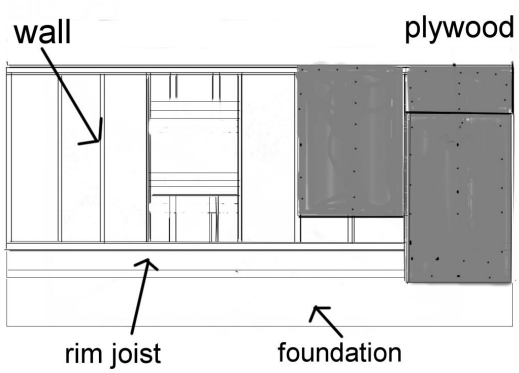


FIG. 5.2

You can offset the sheets for greater strength. The plywood needs to cover the rim joist and sill plate and cover an inch or so of the foundation so water doesn't get in. **Figure 5.2** shows how to nail or screw on the sheets of plywood or wafer-board. The walls will become much more stable once this is finished.

I used a sheathing called T-111. Initially I wanted to save money by using a sheathing that could be painted to save on vinyl siding costs. That was a dumb idea because I really hate to paint. It was sort of an expensive lesson, but it worked out fine anyway.

When you get to the windows and doors, you can either piece together strips of sheathing or just cover up everything and use a router to cut them out. I like to keep the sheets big because it gives more strength. You can use a jigsaw or a saber saw to cut things out either. If you are using plywood, you might consider running the sheets sideways so that the wood grains give more strength.

Wafer-board doesn't matter because the chips run in different directions each glued layer for extra strength. The roof sheathing is applied the same as the walls and the floor. See **figure 5.3**.

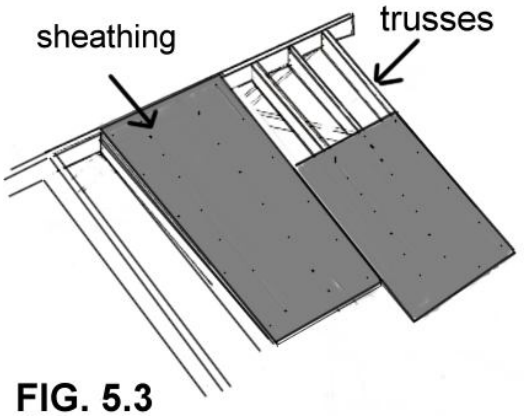


FIG. 5.3

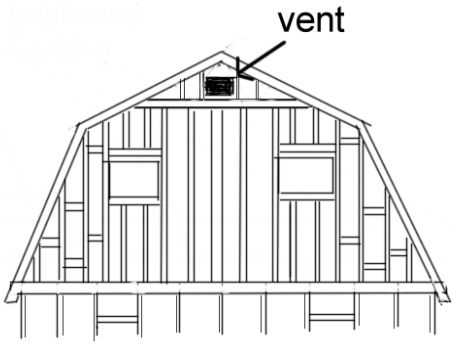


FIG. 5.4

In the attic space, you will need to put a vent in so that there can be airflow to prevent moisture and mold, also to regulate temperatures directly under the roof. The vent is placed above the insulation, but below the truss ridge. It will need to be framed in before the sheathing gets put up. Vent covers can be purchased where you get doors, windows, or siding and retailers will have rough opening measurements. See **figure 5.4**.

If you choose to cover the doors and windows with sheathing and then cut them out with a router or a saw, it will use more sheathing than if you piece it together around the openings. Either way is fine though.

Well that's it for sheathing. At this point, your house will be enclosed except for the doors and windows. From here on, the work will be easier, but a little time consuming. The inside work will take some extra thinking at times, but at least you won't have the rain on your head while working things out.

SIX

Stairways and landings

Building stairs can be a little tricky for first-time homebuilders. If a landing is added, the project can even be more challenging. It's not too difficult to figure out if you just think for a second what it is you are trying to do. Most carpenters don't install stairways until the framing has been completed and some even consider it part of the finish work. It is however; a good idea to know exactly how the stairs will be laid out while you're doing the rough work so the stairway install goes smoothly. You need to consider what type of stairway is best. This depends mostly on what kind of space you are dealing with and what your preferences are. **Figure 6.1** shows a long stairway used mostly in cases where there is plenty of space. **Figure 6.2** shows a stairway with a landing used where space is limited. Also, landings are becoming very popular even in homes with ample living space because they make the stairs seem less intimidating and they add a touch of fun.

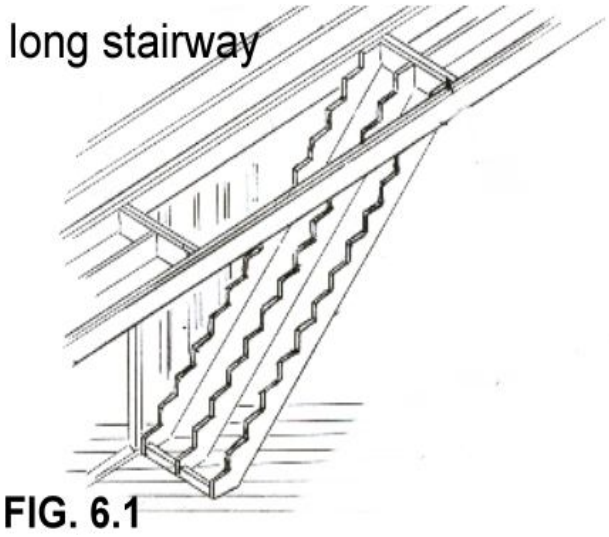


FIG. 6.1

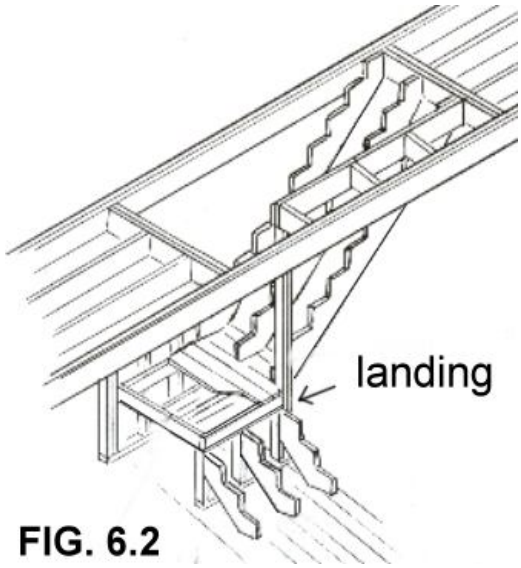


FIG. 6.2

Basically, your stairs have to reach your second floor and you have just so much floor space to do it with. If you look at it that way, it's just a matter of deciding how wide to make the treads, stepping off the number of treads, and then dividing the height of the stairway by the number of treads. That gives you the riser height. There is a little more to it than just that, but there are a few tricks to help with the calculations.

The stairway consists of stringers, treads, and risers. **See figure 6.3**. The stringers can get a little tricky to cut because everything is at a slope. The tread and riser measurements will be in the stringer. The stringer can be made by using a carpenter's square that will keep the cutouts perfect, forming right triangles. **See figure 6.4**.

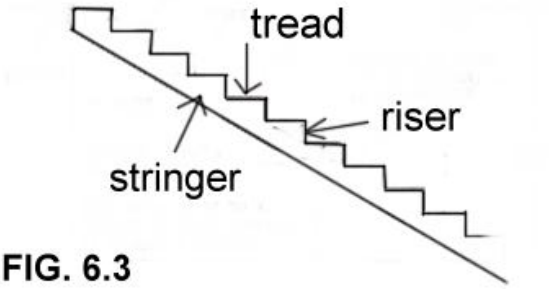


FIG. 6.3

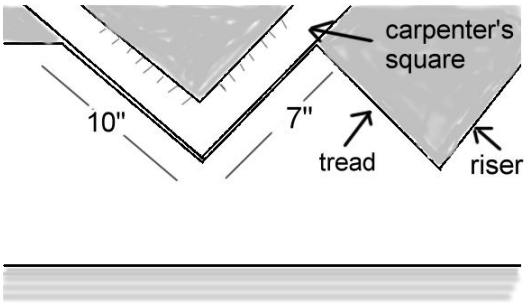


FIG. 6.4

A strong type of lumber needs to be used for the stringers. Usually a knot-free 2x12 is the board of choice. When you make the cut, be sure there is at least 3 1/2 inches of solid material left. If you cut beyond that, the stringer will be weak.

A good way to know the exact riser height is by dividing the total rise by 7. Suppose the distance from bottom floor to top floor including the thickness of the second floor is about 9 feet or 108 inches. 108 divided by 7 equals 15.428. That tells you that 15 risers will be needed. Next, divide 108 by 15 and you get right around 7 3/16 inches or the exact height each riser needs to be. The treads need to be right around 10 inches. The amount of treads will be one less than the amount of risers, so to find the total run or length of the stairs, you just multiply 10 by 14 and that tells you your stairway will be 140 inches long.

With the proper formula at hand, you are ready to mark the 2x12 and cut out the steps. This process usually involves cutting with a circular saw and a jigsaw or saber saw to get to the center of the cutout.

You will need to consider the width of the stairs while doing your framing. Typically, residential staircases are no less than 32 inches wide. Past experience has taught me to go no less than 36 inches for ease in transporting furniture without the risk of scratching the walls. Also remember that there is a minimum amount of head clearance that needs to be observed. It's important to know how the stairs are going to run while planning the rough work, especially if you will be building a landing because the stairs turn at the bottom and if you fail to plan the extra headspace, you'll get headaches. The minimum headroom requirement is 80", but 88" is recommended.

The stringers can be attached to the second floor by using joist hangers. They should also be fastened at the bottom by toenailing or using brackets. **See figure 6.5**.

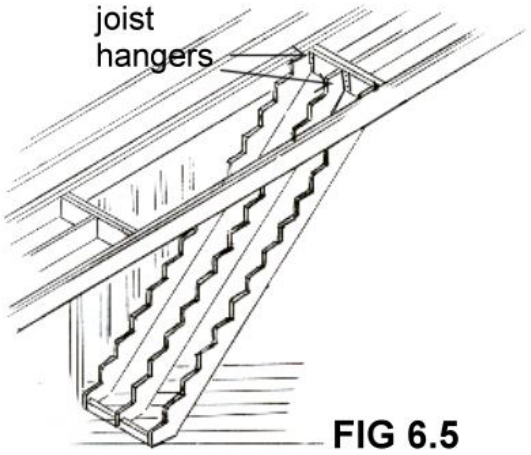


FIG 6.5

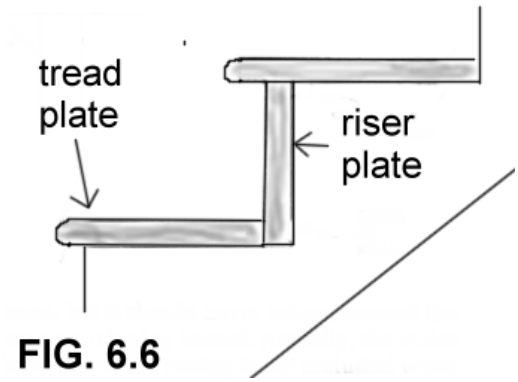


FIG. 6.6

When you put the actual tread and riser plates on, you can use either hardwood or tread material specially made for stairs. If the wood will be exposed, a quality hardwood is best because of the durability. If the stairs will be carpeted, you can buy tread material with the rounded nosing and it will hold up just fine. **See figure 6.6**. It's easier to put the riser plate on first, then the tread plate will lay flush against the riser plate without any gaps. The plates need to be screwed into place. In this case, nails just won't do the job. Also, if the treads protrude any more than 1 ½ inch beyond the riser, it becomes a tripping hazard.

If your plans include a stairway with a landing, you can use the same formula as with the long stairs, except it needs to be done as two separate stairways. The height of the landing has to be measured using the height of the risers. For example, if you find out that each riser is going to be 7 ½ inches, the landing needs to be a square box with the height of either 22 ½ or 30 inches. (7 ½ x 3 = 22 ½, 7 ½ x 4 = 30) It depends on the number of steps you want to climb before the landing. If you use this formula, the landing will fit perfectly into place with the stairs. **See figure 6.7**.

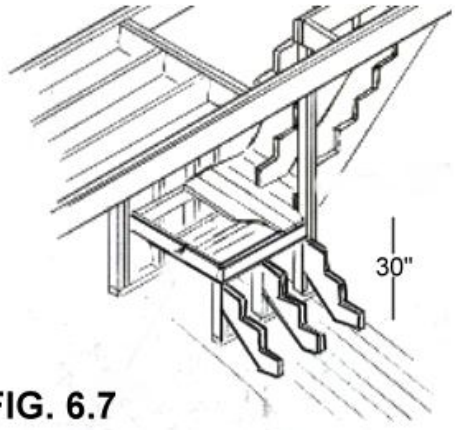


FIG. 6.7

Handrails are an important part of the stairs and need to be fastened securely. Usually, the entire handrail isn't installed until the finish work is being done because of the possibility of scratching or damaging the expensive materials during construction. It might be necessary however; to secure the main support posts to the framework before the walls and floors are sealed up. In that case, you can secure the newel post to the floor joists or stringers as in **figure 6.8**. If you decide to put in the newel post, you may want to cover it to protect it during the rough work. Lag screws help secure the newel post to the joists.

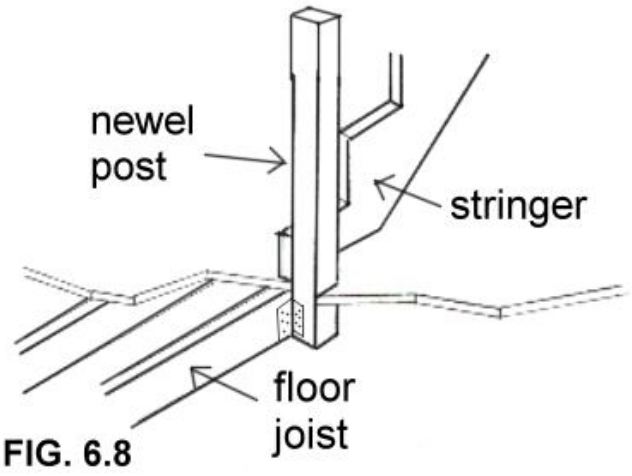


FIG. 6.8

That should give you a good idea about how to make stairs and integrate them into your house plans. Remember, an attractive stairway and handrail is a very strong selling point that sticks out in buyers minds. Appraisers also see them as "goodies", so the time and money invested will be well spent.

SEVEN

Installing entry doors and windows

When I started my house, I was hell-bent on saving money on labor costs. More so now than ever do I practice what my father has taught me over the years by his example to not have someone else do a job for you that you can do yourself. That concept is what makes this whole plan work. You will save literally hundreds of thousands of dollars in the long run by doing your own labor work.

Now, having said that, there are a few instances where you can actually save money and time by buying prefabricated components. When my brother and I built our rustic (ugly) log cabin many years ago, we did everything from scratch. We even bought the glass for our windows and made panes with wood and silicone. The windows are still there and in good condition, but what a pain it was to cut the glass and to fit each piece into place. We probably spent more money building our own windows than it cost to buy them.

There are many choices of pre-hung doors and boxed windows that are very reasonably priced and are a dream to work with. You just slide them into place, adjust them slightly with shims, and screw them down. It is my strong recommendation to take advantage of the prefabricated doors and windows because it will save a lot of time and probably even a little money. There are just a few important points to cover in terms of exterior doors before we get into the nitty-gritty of installing them.

You will need to consider the width of entry door you want. If you go smaller than 30", you will have a bugger of a time getting a refrigerator and sofa through the door. A 36" door seems really wide, but you'll appreciate it when you're lugging a heavy, oversized, sofa/hide-a-bed through it. Also, most entry doors are metal or hardwood. Metal doors are inexpensive and work just fine. You'll pay out the nose for a hardwood entry door, but it will be an eye-catcher for appraisers and future buyers.

It's alright to splurge every now and then for the "good stuff", but remember this, if you go for expensive quality for every component in your house, you won't be able to build it inexpensively. I'm not saying to build a low-quality house with cheap materials, but rather to build a house with quality and affordability in mind.

Also, if you choose to use expensive materials, you will reach the point of diminishing returns. Here's an example to clarify that statement. A 2,000 square foot home built using quality yet affordable materials will cost around $60,000. A 2,000 square foot home built using all expensive and very high quality materials will cost around $90,000. The resale value of the practical home will be around $130,000, while the resale value of the expensive home will only be around $145,000. Not too much difference between the two because a home is usually valued using the comparative approach. In some cases, a home will be appraised using the cost approach that actually takes into consideration the cost of materials used in the construction. By and large however, a home will be valued by comparing it to similar homes in the neighborhood that have sold recently. The appraisers try to note all the "extras" which raises the value of the home, but the difference usually isn't dramatic.

I'm including this little tidbit of advice here at the windows and doors section because at this point, you will have to decide whether to buy hardwood doors and window casings or inexpensive metal doors and vinyl cased windows.

One more item of importance on entry doors is the use of sliders. A slider makes a poor entry door. Sliders are great for backdoors though. You can also use French doors as a back door. Regardless of which of the two you choose, make sure that they have tempered glass. I can't believe that there are still plenty of cheap glass doors without tempered glass out there. When my wife and I went to buy our downstairs slider, and our French doors upstairs, my wife made it clear that they would be made of tempered glass. I never gave it much thought before that. The doors with tempered glass cost quite a bit more than those without safety glass. We bought the doors with safety glass and I installed them. About two years after moving into our house, my wife and I came home one night to find someone had been in our house while we were gone. It must have been a child or children because the secured glass door of our slider had been run into from the inside. An indented hole about 4' up the glass was the obvious center of contact. It was about the size of a child's head and it was hit hard. The entire door was cracked up, yet not one piece of glass broke free. We never found out who was there that day and that's just fine. Kids will be kids. Get safety glass!

Now that we've gone over all that, it's time to pick some doors and windows that will make your home beautiful. Typically, inexpensive homes are built using vinyl siding with vinyl windows and metal doors. Also they have either metal or asphalt roofs depending on the climate. These things all matter because they will have to match and coordinate as the exterior finish or siding is put up. Doors and windows come in many varieties and colors. Metal doors can be painted to coordinate well with siding colors if you can't find a door that comes in the color you prefer. Vinyl windows can't be painted, but white or ivory vinyl will match about anything you can throw onto the walls. You can get solid metal doors or doors with windows depending on your tastes.

You can also get doors in just about any height you want, but the standard size is 6’8”. **Figure 7.1** shows a few types of entry doors. You have hardwood which is obviously made of wood, you have the paneled door which can be either wood or metal with square panels, and there’s the lighted door which can be either wood or metal, but has glass windows in it. **Figure 7.2** shows a slider and French doors.

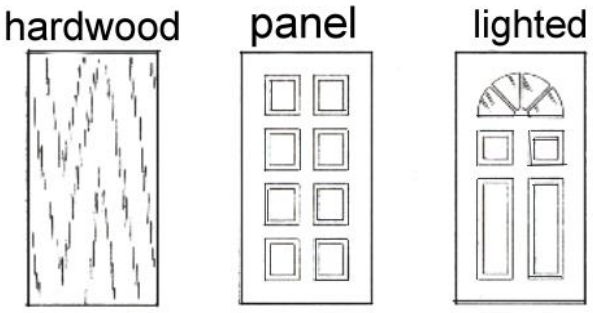


FIG. 7.1

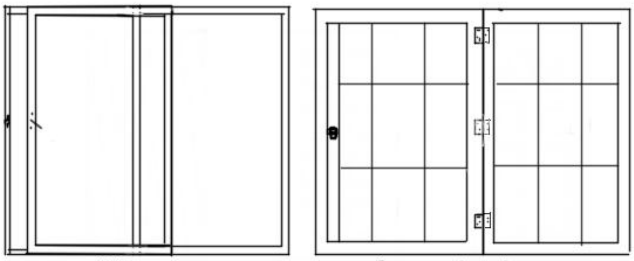


FIG. 7.2

Prefabricated doors come with the jambs, stops, and hinges already mounted so you only have to put them into the rough opening and center them using tapered shims.

FIG.7.3

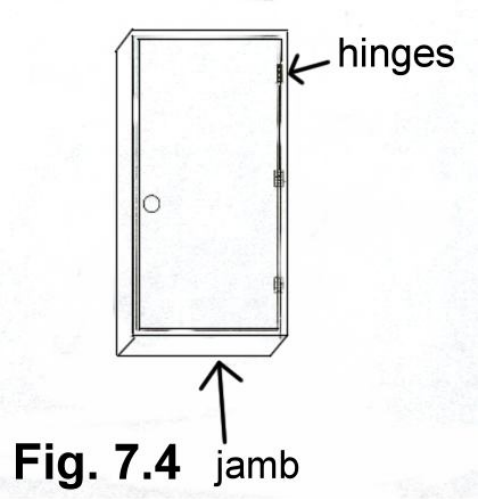


Fig. 7.4

Figure 7.3 shows a door rough opening and **figure 7.4** shows a pre-hung door ready to slide into the rough opening. After the door is in place, you should have a gap all the way around between the jamb and the trimmer stud in the door opening. You will first need to place shims under the doorjamb on the bottom. You need to raise the door to compensate for the finish floor and the finish floor covering. If you will be using 5/8 inch particleboard on the finish floor, you will have to raise it that much plus the thickness of the floor covering whether it is carpet, tile, or hardwood. Next, insert the shims all the way around the doorjamb making sure that the gap is even. **Figure7.5** shows the best way to use the wedged shims and **figure 7.6** shows proper placement of the shims before screwing the door in place.

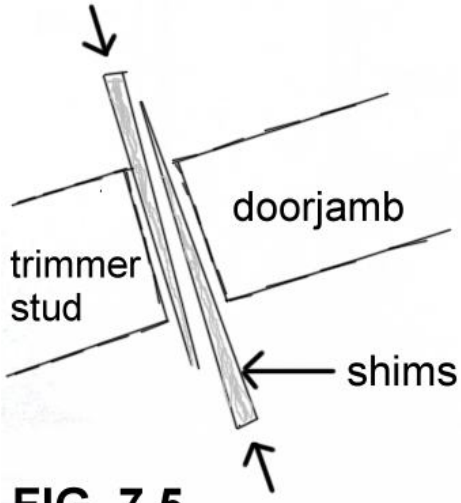


FIG. 7.5

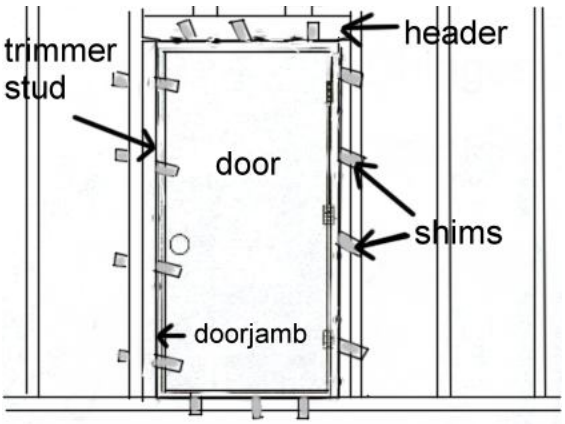


FIG. 7.6

After you get the door completely centered, then you can secure it in place with screws. I use 2-inch brass wood screws. I use screws because you can adjust them if you need to. That helps you keep the door centered. Also, because you are putting screws into the doorjamb from the inside means that the screw heads will be visible. The holes can be filled in with wood putty before painting. If you can't sink the screws in far enough to make a hole for filling, you might want to drill a hole first using a counter-sink bit.

Once the door is secured with screws, you can open the door to see if it is level. The door should stay open at any angle. If the door isn't level and flush with the wall, you will need to make some adjustments. If you have done everything according to plan however, there shouldn't be any problems. The door should open and close with ease. Next, you can knock off the shims that are protruding with a hammer. They break easily and the shims that are stuck in the wall will be covered up by sheetrock and trim. Interior doors are done exactly the same way.

The door hardware is quite simple to install, especially if the prefabricated door has the holes already drilled. **Figure 7.7** shows the parts of a doorknob and how they fit together. **Figure 7.8** shows the striker plate assembly and how it attaches to the doorjamb.

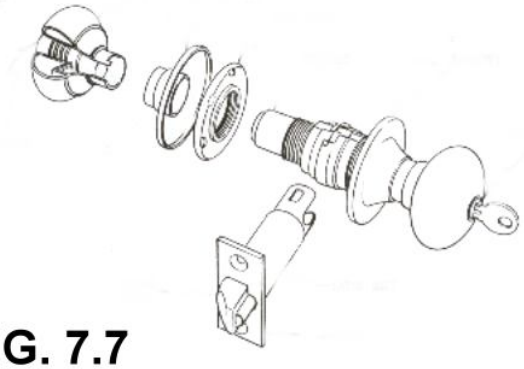


FIG. 7.7

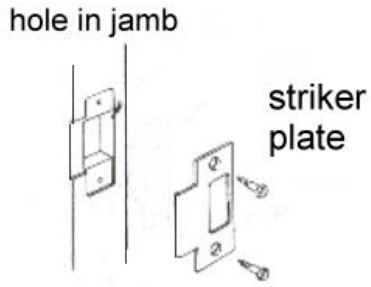


FIG. 7.8

If you're installing a vinyl slider, or vinyl French doors, they might have a flange flashing all the way around where you can just screw them directly to the trimmer stud on the door opening without using shims. In this case, it's still a good idea to use a few shims and to get help installing the door because they are heavy and difficult to center. **See figure 7.9**.

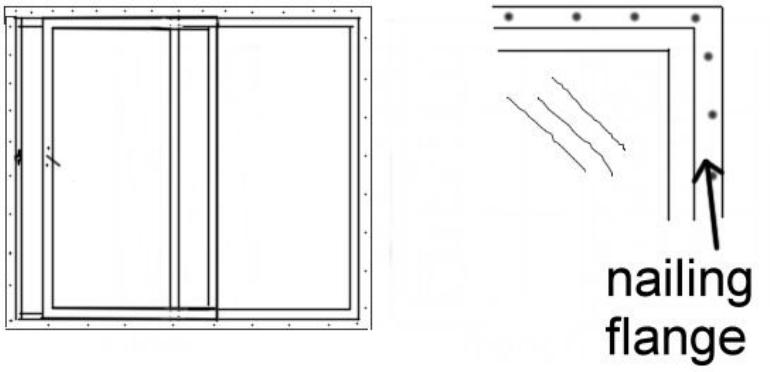


FIG. 7.9

You can use much shorter screws on these kinds of doors. 1" brass screws work really well. Sliders have to be perfectly level and square or the sliding mechanism binds and the door will be hard to open. Even the heaviest of slider doors should be able to be opened by a small child. The sliding door moves on a rail. This rail may need to be polished on occasion with silicone spray. The door lock on a slider will be a small lever with a hook that catches the striker latch when engaged.

Now, let's move on to the windows. The windows are easier to install than the doors. There are only a few things to consider when buying windows. Mostly, the considerations depend on your preferences and your budget. Shop around for the best deal on windows and don't let a salesman try to sell you something you don't need. I say that because windows can be very expensive or very reasonable depending on the manufacturer and the type. Either will work just fine so don't let someone sell you handcrafted wood-framed windows when all you need is vinyl-framed windows. They will probably give you the spill about condensation and UV rays that less expensive windows don't prevent. Most of it is hype, so just try to avoid salesmen when looking for windows. Here are a few kinds of the more common windows. **See figure 7.10 and 7.11**.

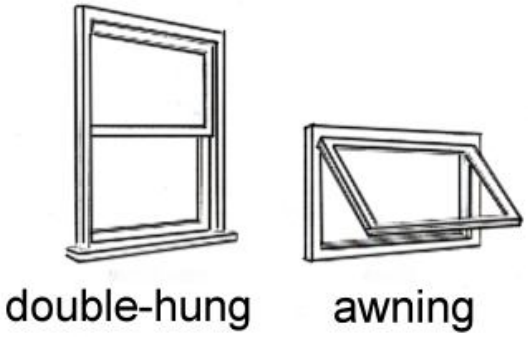


FIG. 7.10

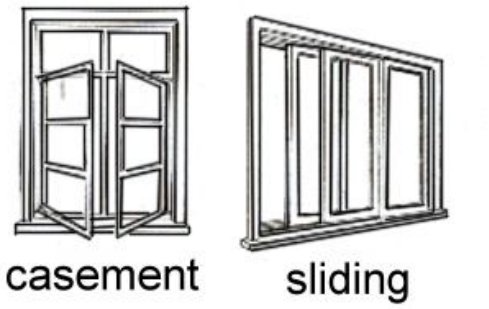


FIG. 7.11

The double-hung and sliding windows are the most popular. Casement windows are usually more expensive. There are also a few of the fixed-frame varieties where the window doesn't open at all. They are mostly used for stairway illumination, skylights and bathrooms. The easiest windows to install are those with a flange. **See figures 7.12, 7.13**.

FIG. 7.12

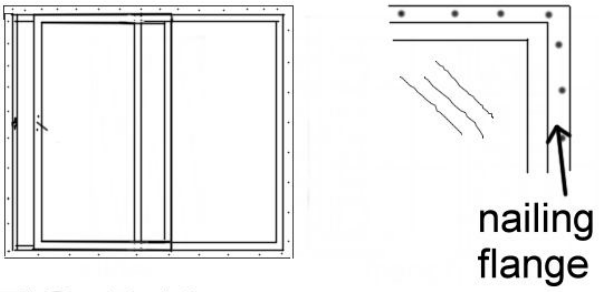


FIG. 7.13

The windows attach directly to the rough opening from the outside. You will need to use shims on the inside so that you can be sure the window is perfectly centered. The shims can be broken off or removed once the window is fastened. The rough opening needs to be perfectly square. If the window isn't centered just right or if the rough opening isn't exactly square, the trim that goes on the inside of the window during the finish work won't fit well and the misalignment will be very obvious every time you look out the window. Once the window is centered, fasten it with screws. **See figure 7.14**.

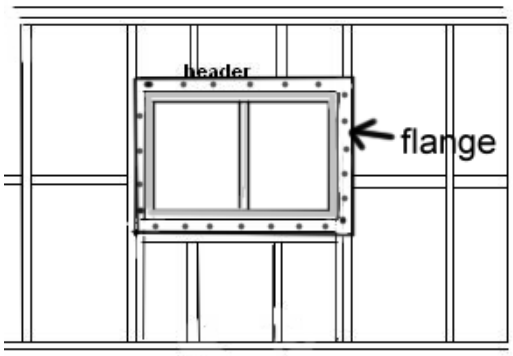


FIG. 7.14

The siding will cover up the flange when the exterior work is done. Keep the windows shut and locked until completely fastened and secure. The windows that don't have a nailing flange are usually a casement type that needs to be fastened from the inside like a pre-hung door. **See figure 7.15**. Nail through the shims for stability. **See figure 7.16**.

FIG. 7.15

FIG. 7.16

The windows will have about ¼ inch gap all the way around which will need to be filled with insulation. The trim that goes on the inside of the window is either hardwood or MDF. (Medium Density Fiberboard) The hardwood is expensive and used mostly for wood-cased windows. MDF is a tough type of particleboard. It comes in different widths. The wall thickness will determine the width to be used. It can be painted to match the inside wall color. MDF is easy to work with and really inexpensive. I'll cover trim a little later.

After the windows and doors are in place, you can start the siding. The house looks quite ugly until that happens.

EIGHT

Plumbing

Plumbing isn't nearly as complicated as it looks. The plumbing codes might also be confusing and even discouraging, but if you take a little time to figure it out, you'll see that it's fairly easy and quite fun. Also, in the interest of saving money, you will want to use plastic piping instead of metal wherever possible. I will give thorough procedures on both plastic and metal pipes, but if your local codes allow the use of plastic pipes, (and most do) then you can save a lot of money, time, and sweat.

The components of plumbing consist basically of three things: a fresh water system, fixtures and appliances, and a drain system.

Fresh water systems- These are the pipes that come from either city water supplies or wells. They enter the house through a mainline and usually make the first branch or tee at the water heater. These lines are always under pressure and connect to the inlet on all plumbing fixtures and appliances (sink faucets, baths, toilets, washers, spigots, etc.). They can be plastic, copper, or galvanized iron. They are small in diameter, usually ½ inch to 1 inch. Water lines are joined together with watertight fittings. **See figure 8.1**.

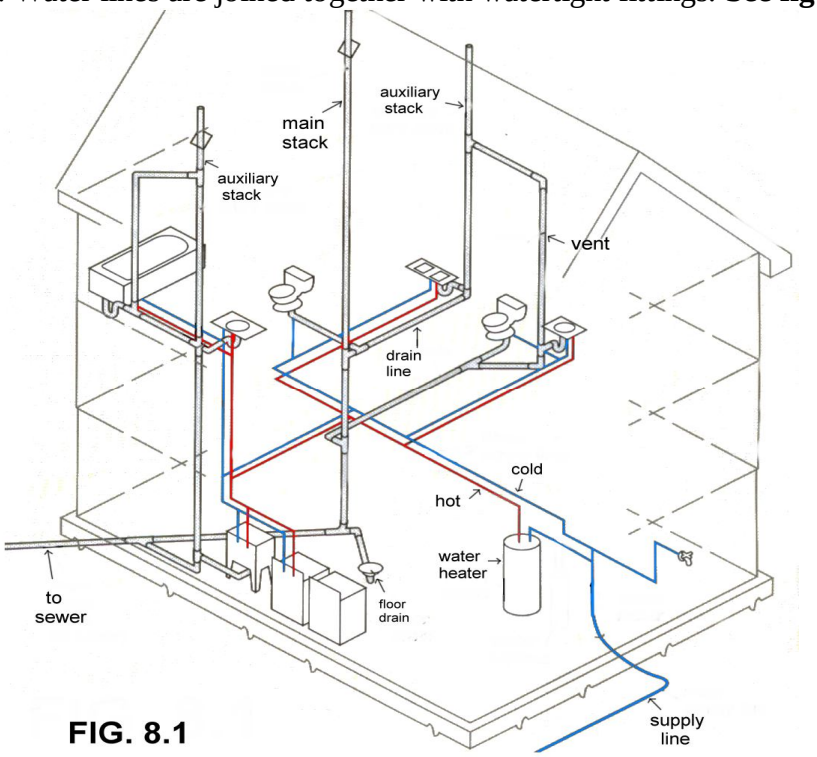


FIG. 8.1

Fixtures and appliances- These are self-explanatory, but they each have a specified amount of codes and regulations that will need to be followed before they are installed. Waterlines going to each will have to be a minimum diameter, and waste lines from each will have to be a certain size as well. These pipe sizes need to be planned out well before the appliances are ready to be installed.

A drain system- This is everything going from the fixtures and appliances to the septic system or city sewer. The common acronym for this system is the DWV (Drain-Waste-Vent). The drains will carry away wastewater, but there are bigger pipes that are part of the waste system that carry solids called soil pipes. Also part of drain waste lines is P-traps, which create a water barrier so that sewer gases can't get into the house. All fixtures and appliances will need to have P-traps in the waste lines with the exception of toilets. Toilets, by design, already have the U-shape water barrier that is essentially a P-trap. Vent pipes that run from waste lines to the roof allow sewer gases to escape. Sewer gases can build up and break through traps if venting is inadequate. Venting also helps maintain atmospheric pressure, without even atmospheric pressure, water can be siphoned out of P-traps and the water seal is lost. **See figure 8.2**.

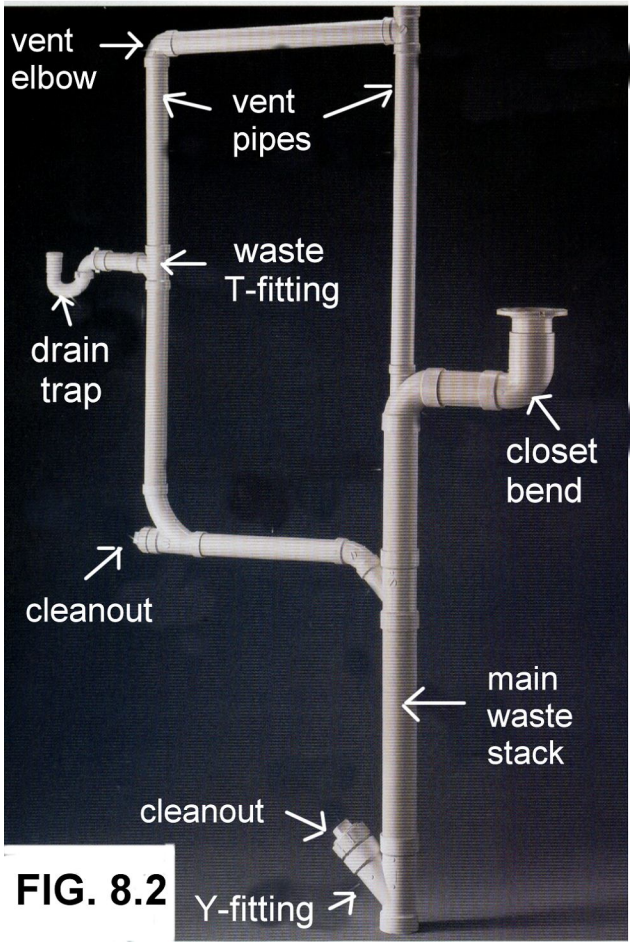


FIG. 8.2

Let's start off with the fresh water system. You need to have a waterline coming from a well or a city water supply. Most mainlines will be made of 1-inch pipe, but some codes allow ¾ inch. The main water shut-off needs to be installed somewhere easy to get at. It needs to be between the main waterline and the water heater. From there a ¾ inch pipe goes to a branch where one line is feeding into the water heater, the other line will service all the cold lines in the house. There will be a line coming out of the water heater that will run along side of the cold line to all the fixtures.

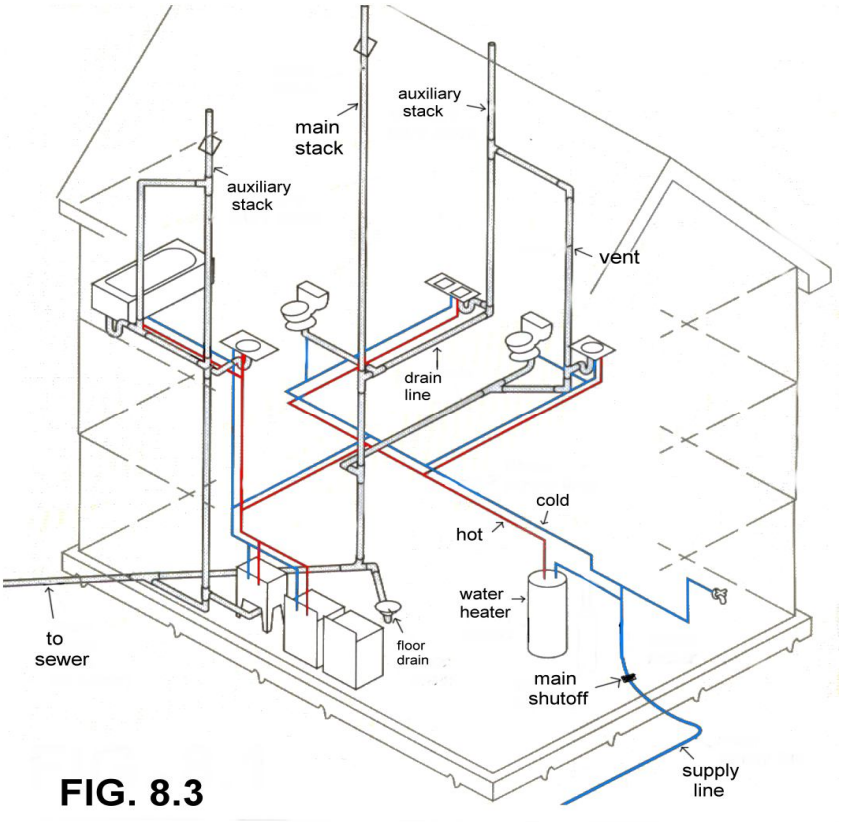


FIG. 8.3

Figure 8.3 shows how the cold and hot lines are routed to the different fixtures. When copper or galvanized pipes are used, this is usually the way it is run. Most often, ½ inch pipe is used.

There is also another way to do this, which is becoming more and more popular. About 20 years ago, plastic tubing called polybutelyne or PB tubing was being introduced into new residential construction. The idea was great, but the plastic wall in the tubing was too thin and there were several mishaps after a few years of use and PB went away. Since then, a few new plastic products have been introduced, but there are a few states that still remember the PB incidents and won't allow the use of poly tubing. The kind of tubing mostly used is Qest or also called Pex.. It is a stiffer and thicker plastic material than the older PB. It is a dream to work with because of the flexibility and it's much cheaper than copper and galvanized pipe.

With Qest, everything is run directly off a manifold. Each fixture in the house will have a separate line feeding it. The manifold acts like a hub and is located near the water heater. It is basically a box with two sections, one section for cold water, and one for hot water. A fresh waterline goes into the bottom and feeds all the cold-water fixtures. It also has a cold line running to the water heater. The water heater then has a line for hot water that runs back to the manifold and feeds the hot-water fixtures. See **figure 8.4**.

FIG. 8.4

FIG. 8.5

Each fixture has its own dedicated waterline. The red (hot) or blue (cold) tubing usually runs side by side from the manifold to each fixture. The flexibility of the tubing makes it a dream to work with. **Figure 8.5** shows the different sizes of tubing. **Figure 8.6** shows how a typical Pex fresh water system is installed.

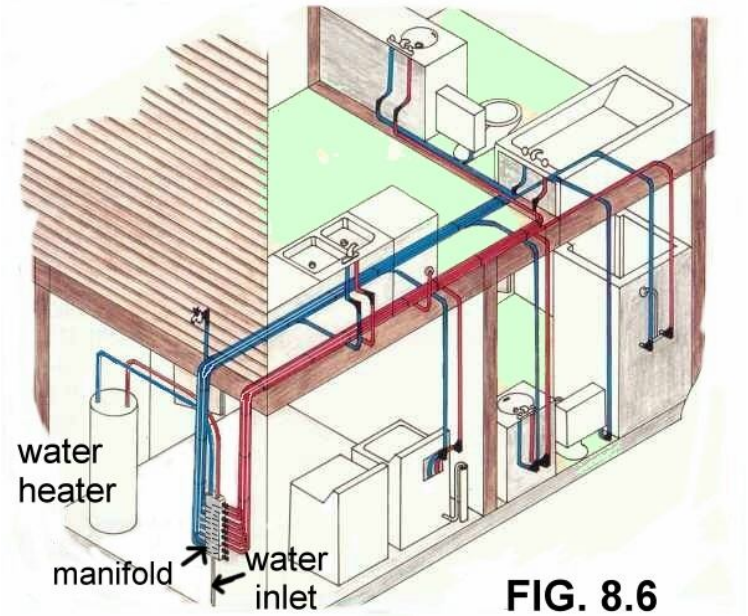


FIG. 8.6

The Pex tubing has many different fittings made of either brass or poly. These fittings slide into the tubing and are crimped in place with crimp rings and a crimper. **See figure 8.7**.

FIG 8.7

In my opinion, Pex is a good alternative to expensive copper or galvanized pipe. It is very inexpensive and is so easy to work with. The one thing however; that is uncertain about Pex, is the long-term effect of chlorinated water on the vinyl walls in the tubing. There is little reason to suppose that a chemical reaction between chlorine and the vinyl, could cause the tubing to weaken over time, but nobody really knows for sure yet. The new product does seem to be very dependable. It outperforms metal pipes in extreme cold conditions because of its resiliency. Copper and galvanized pipes freeze and break if they are left unprotected in the cold. Pex can usually freeze and thaw several times before it breaks. Don't confuse Pex with CPVC. CPVC is a type of stiff vinyl that is used mostly in mobile homes. It is a poor product in cold weather. It shatters easily and is not that easy to work with. I don't like it because I have had to replace it with Pex many times in campers and trailers that weren't properly winterized.

Plastic tubing is a much simpler approach to fresh water systems than copper or galvanized, but before you make any plans, you need to first find out if it is legal to use. There are a few areas where no form of plastic pipes is allowed, not even ABS for waste lines. Installing cast iron pipes is a whole lot of no fun and it's spendy, but sometimes there aren't any other options.

When you use plastic tubing for fresh water, each line is dedicated to its own fixture so you don't need to put a tee in the line anywhere. That way the pressure remains constant. About the only place where a tee is acceptable is for a refrigerator waterline that runs the icemaker and water through the door. It isn't really even a tee though. Refrigerator lines are just a small flexible tube that attaches by means of a puncture seal that you twist until it forces a hole in the poly or copper waterline and makes a tight union.

So basically, you attach one end of the Pex tubing onto the manifold using a female hose fitting, run the line to the fixture, and then attach it to the fixture using another female hose fitting. You can secure the tubing to the floor joists and wall studs with plastic holders made exclusively for Pex or Poly. Don't use metal fasteners that are normally used for copper or galvanized, because they could wear a hole in the tubing over time. Flexible plastic lines are light and they vibrate more than metal lines do. Pex comes in a few different sizes. The water mainline coming into the manifold will probably be a 1-inch line of strong poly. You will want to have a main water shut-off valve before the manifold. The cold waterline from the top of the manifold that goes to the water heater will probably be a ¾ inch Pex line as well as the hot waterline coming from the water heater back to the manifold. You can use 3/8-inch thick pex for the individual fixture waterlines if you want, but ½ inch delivers a larger volume of water and is preferable.

Copper and galvanized lines are run in a straight line usually both hot and cold side by side with tees or branches servicing each fixture. **See figure 8.8**.

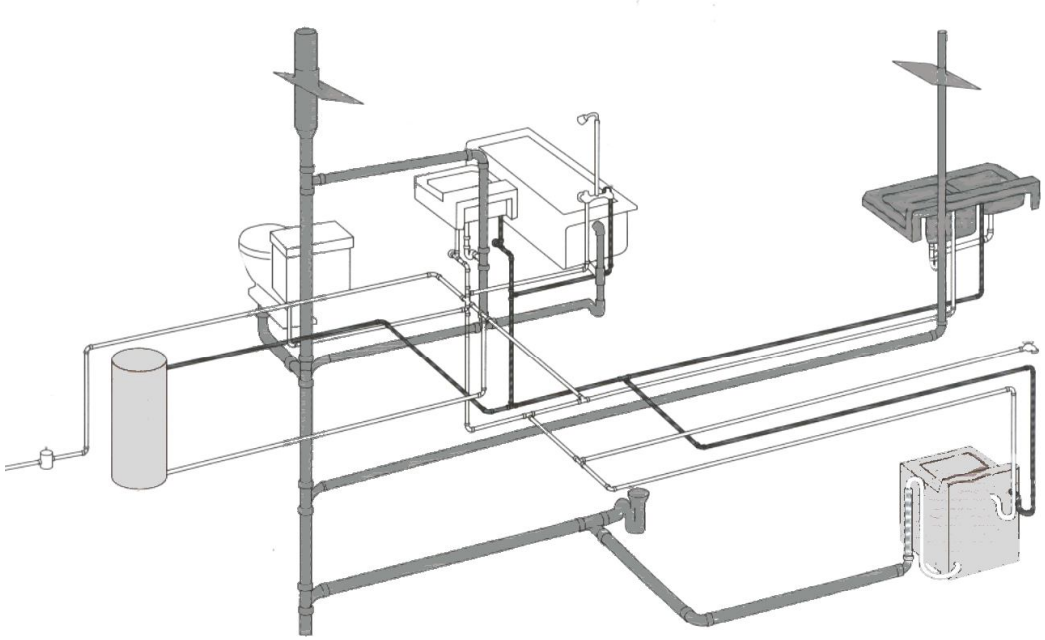


FIG. 8.8

Metal lines are not complicated things by any means. They are more expensive than vinyl tubing, but they are really kind of fun to put together and the value of the home will be a little higher. There are many different fittings that make the job easier. You start out by measuring the pipe to the length you need, then you cut it with a pipe cutter. **See figure 8.9**. After cutting the pipe you will need to clean out the inside with a burr remover. **See figure 8.10.** Once the pipe is burred, shine the end with an emery cloth. **See figure 8.11.**

FIG. 8.9

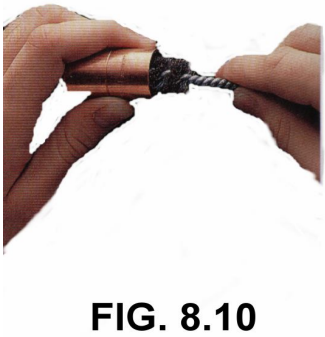


FIG. 8.10

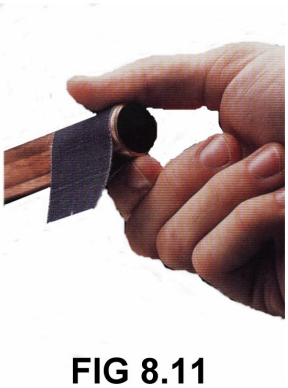


FIG 8.11

After the pipe is cut, burred, and polished, it is connected by a process called “sweating”. First, you take the pipe and brush on some soldering paste or rosin flux. This also helps clean the pipe while it’s being heated. Apply the paste to the outside of the pipe and the inside of the fitting as shown in **figure 8.12.** After joining, take a propane torch and heat the pipe and fitting thoroughly to the point where the paste starts to sizzle. **See figure 8.13**. At this point, you move the flame about an inch down the pipe away from the joint and touch the joint with solder. If the pipe is hot enough, it will suck the solder into the joint and make a complete circle around the joint, making a tight seal. **See figure 8.14**

FIG 8.12

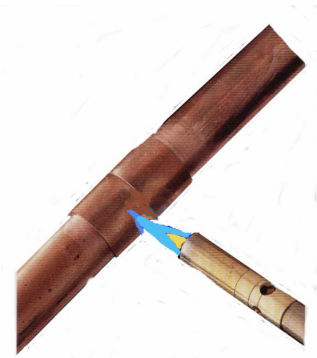


FIG 8.13

FIG. 8.14

After you melt the solder into the joint, carefully wipe away any excess solder with a heavy cloth. Don't forget that the pipe is hot! Piece by piece, you will install the pipes in this manner. You will probably have to bore a few holes in the joists and wall studs to run the pipes through. You need to be extra careful while working close to the framing not to catch things on fire. Just to be sure, you may want to have a garden hose ready to extinguish any flames. Also, you need to make sure that you have adequate ventilation while using a propane torch. Not all the gas that escapes the nozzle gets burned up and it can build up in a confined place and ignite. That's never good.

So to run a copper waterline we know that a main line runs to the water heater, then branches off from the water heater and goes into a cold line and a hot line. The two lines will run as far as the furthest fixture with branches or tees servicing all the fixtures between. Remember, toilets or water closets only need a cold line. Here are a few examples of some important fresh water fixtures. The diagrams are pretty much standard for copper and galvanized systems. Apart from the pipe runs, you will have to know how to connect the fixtures to the pipes. We will start with the water heater, as it is the first actual fixture in line because it supplies hot water for the other fixtures. Water heaters typically have a ¾ inch cold water line on the intake, a ¾ inch line on the outlet, and a pressure relief valve. **See figure 8.15**. They are also equipped with a spigot at the bottom for hot water access or to drain it. **Figure 8.16** shows a gas water heater.

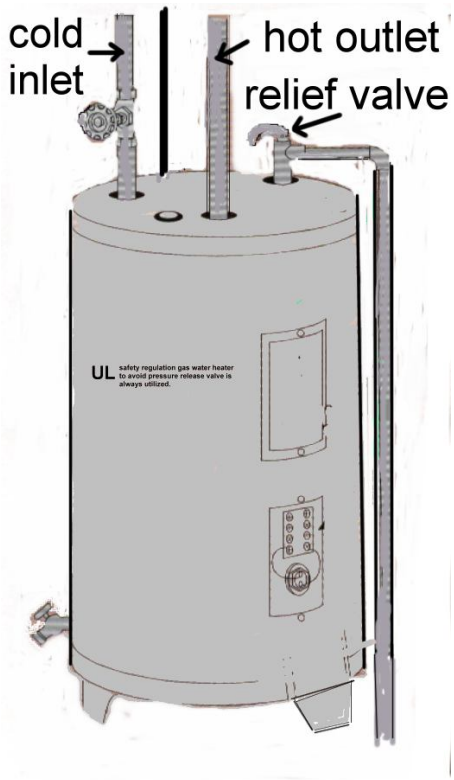


FIG. 8.15

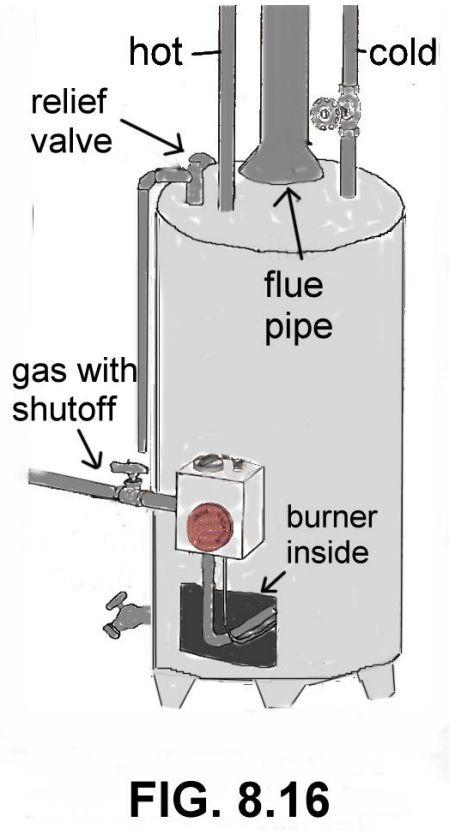


FIG. 8.16

The relief valve and overflow line need to made of either copper or galvanized because of the possible high water temperature they might have to withstand. Also, in most areas, the overflow will have to be diverted under the floor and outside the foundation onto the ground to prevent anyone from getting scalded.

Let's move on to some other fixture connections. Bathrooms consist of a sink, a bath/shower, and a toilet. The waterlines will need to be routed so that they branch off of the main lines and into the walls where each fixture will be located. **FIG. 8.17** shows the bathroom layout.

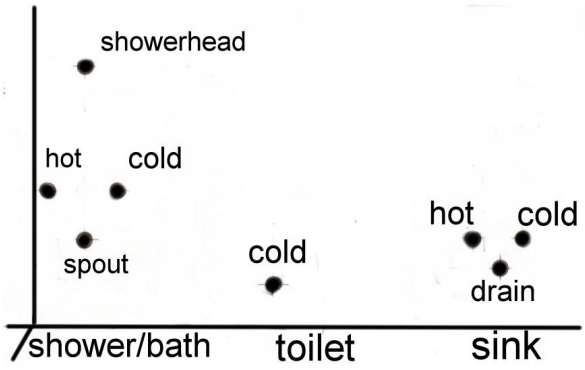


FIG. 8.17

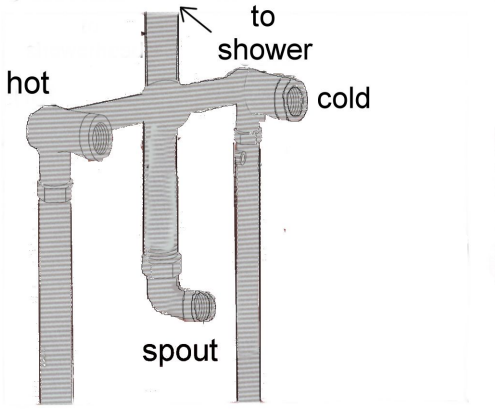


FIG. 8.18

Figure 8.18 shows how the shower/bath assembly works. You can usually buy this piece as a whole unit that's already measured and ready to install. **Figure 8.19** is how you install the sink shutoffs with compression fittings. The fittings will screw onto the pipe nipple. Copper and galvanized pipe nipple fittings have threaded ends for termination fittings to screw on and for branching off of the mainline.

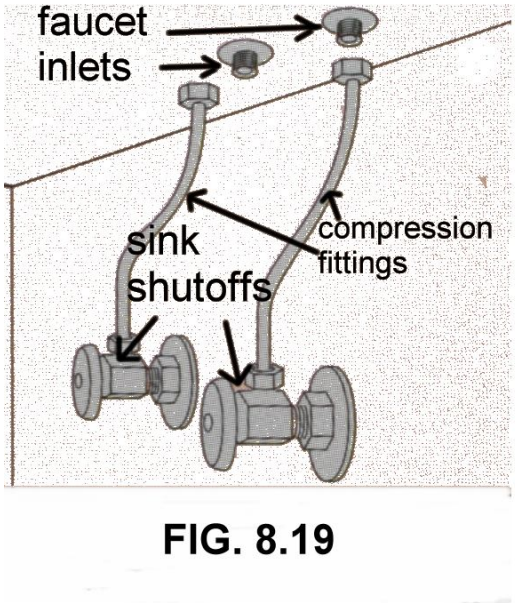


FIG. 8.19

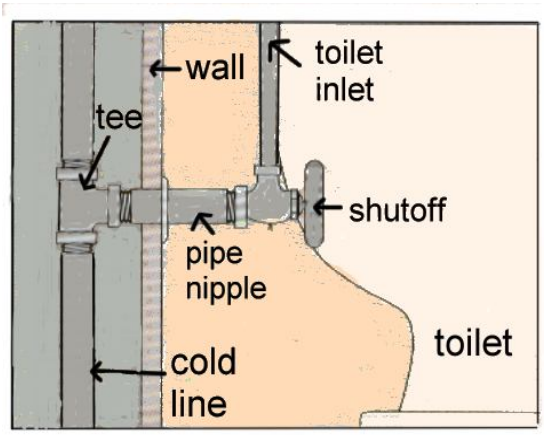


FIG. 8.20

The kitchen plumbing is basically like the bathroom sink except for the difference of a dishwasher, which only takes a hot line. **See figure 8.21**. The laundry room will require

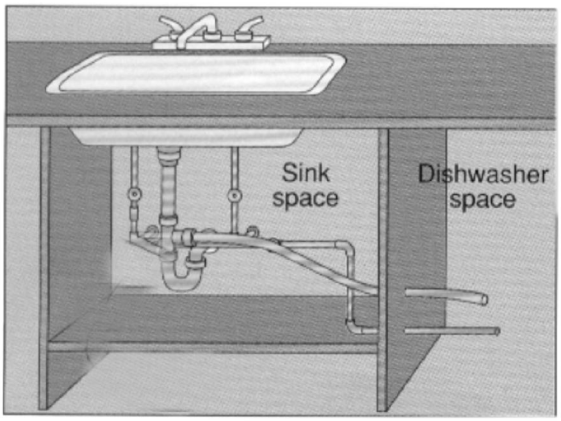


FIG. 8.21

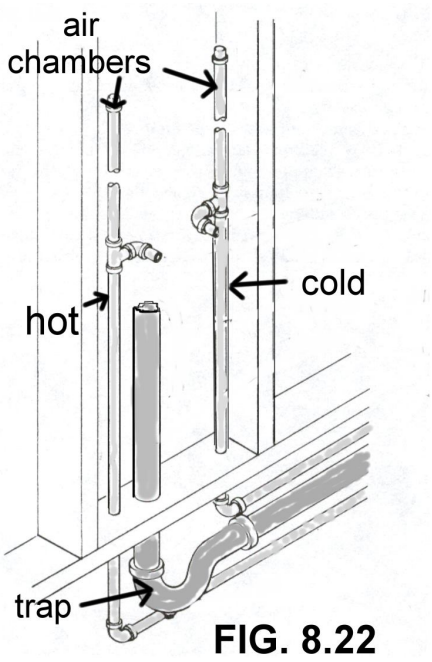


FIG. 8.22

a hot and cold line also. **Figure 8.22** shows how to run the hot and cold lines. These lines are usually brought together in a recessed wall box with spigots to hook up the washer supply lines as well as a waste line for the washer to pump out dirty water. **See figure 8.23**.

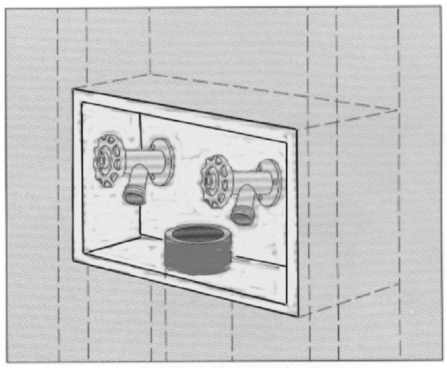


FIG. 8.23

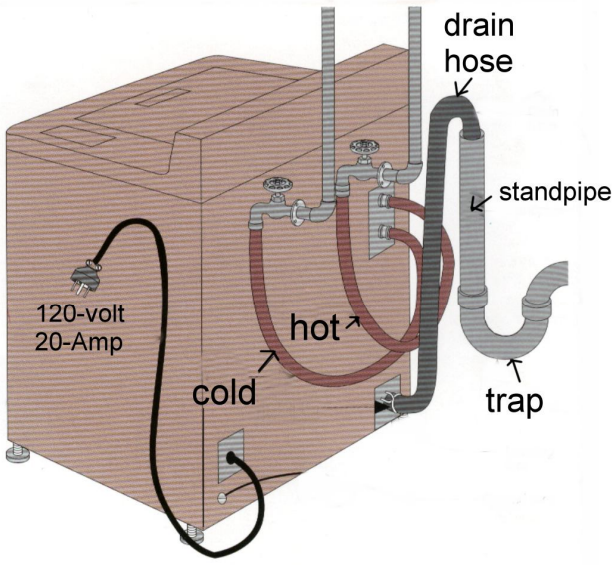


FIG. 8.24

Figure 8.24 shows how the hot and cold supply lines connect to the washer. It also shows the waste water pipe with drain hose and trap. One more thing to think about at this point is that many people like to have a deep laundry sink by the washer to soak extra dirty clothes. It's a good idea if you have space to do it because the cost is quite minimal being that the water and waste lines are there already. Deep plastic sinks are very reasonable and really handy if you get dirty a lot.

Before we move on to the Drain, Waste, and Vent systems, there are a few things I should mention. First, I don't talk much about galvanized pipe because it is expensive and difficult to work with. If you do have to use it, you can usually rent thread makers from plumbing stores. It takes a little practice at first, but so does everything. Another thing is that quite often, copper and galvanized pipes will leak around the threads if you just screw them together. I like to use Teflon tape for that. Just wrap the threads a few times before screwing the pieces together. You can also use RectorSeal on water lines, but it is used more often in small copper propane and natural gas lines. Both are available at any plumbing store

You will need to do a pressure test on the water lines before connecting any fixtures. It is a good idea to do pressure tests on both the water and septic lines at the same time so the plumbing inspector doesn't have to show up twice for the same inspection. Most waterline inspections are just a simple matter of turning on the water and checking for leaks, but you may have to do an air pressure test. If so, you can cap off all the water lines with test caps and then integrate an air compressor and gauge in the line. The line will need to hold constant air pressure for a specified amount of time. The septic lines will definitely have to have an air pressure test, but it's not too bad. You just cap off all the waste and vent lines with plastic caps or test balloons made especially for testing waste systems and integrate an air compressor and gauge in the line. The usual pressure for waste systems is only 5 pounds for 15 minutes. **See figure 8.25** Once the inspection has passed, you can knock out the caps and move on to other things. **See figure 8.26**

FIG. 8.25

FIG. 8.26

Make sure that the inspector has approved your work before you put the sheetrock on the walls. They get cranky if they can't see your work.

Now, it's time to move on to the Drain, Waste, and Vent systems. Most plumbers now use plastic pipes for these systems because of the ease of use. Plastic is much lighter, cheaper, and more flexible than cast iron. It really is fun to work with. If your local codes prevent the use of plastic, then you'll have to use cast iron. By and large though, plastic is an acceptable product to use.

Two types of plastic pipe are PVC and ABS. **See figure 8.27**. Both are readily available and inexpensive, but the better of the two is probably the PVC. It is more durable than ABS. There are a lot of plumbers that still use ABS because it was the first plastic product for DWV systems and they have grown attached to it. I think that both are fine to use.

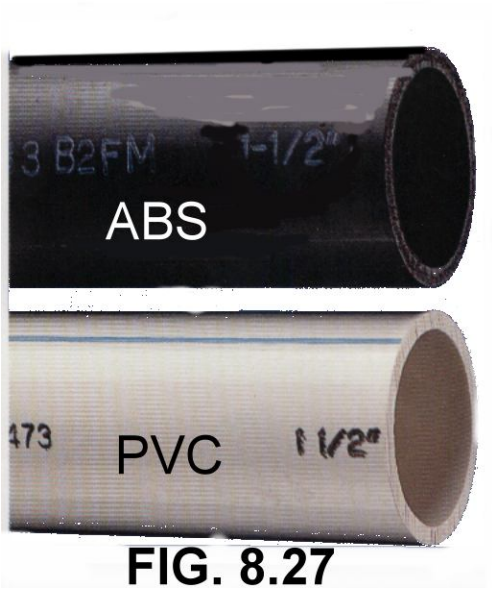


FIG. 8.27

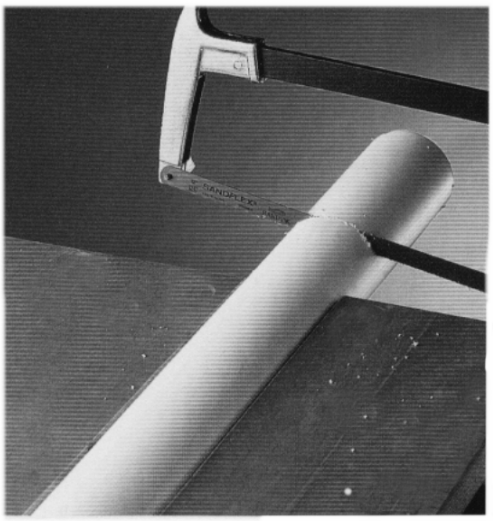


FIG. 8.28

Plastic pipe is extremely easy to cut. You can use a small-toothed saw, or a pipe cutter. **See figure 8.28**. One thing that is crucial to remember is that when you cut plastic pipe, it leaves behind burrs that need to be taken off with a utility knife on both the inside and outside. If you forget to do this, things will snag on the inside of the pipes and you will have a lot of plugged lines after awhile.

When you do the DWV layout, you'll use many different fittings to help with corners, branches, traps, and cleanouts. It is always good to do a dry run with all the pipes and fittings before gluing them together. After you cut and burr the pipes, put them all together to make sure they are the right length. After you know for sure that everything fits, you can use the joining compound and cement them in place. ABS and PVC cement is a one-time try. It welds the pipes and fittings together almost instantly. If you do need to get them apart after cementing, you're better off cutting the pipe apart with a saber saw and putting in a coupler. Remember, even if you can get them apart by pulling hard, the cement will leave a residue on the pipe and it will be a leaker. We've all done that before.

When you put the pipes and fittings together, make sure they are in all the way. This gets a little difficult when the pipe has to run through joists and studs and is often times hard to reach. A good seal is understandably important though. Let's go through the most common fittings that are used in the DWV system. **See figures 8.29 - 8.32**.

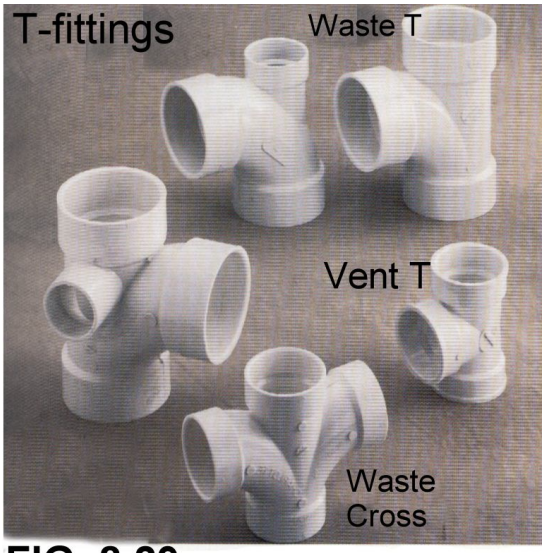


FIG. 8.29

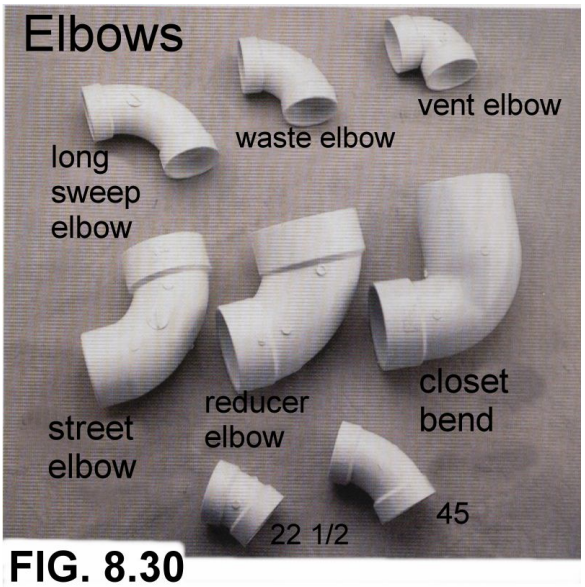


FIG. 8.30

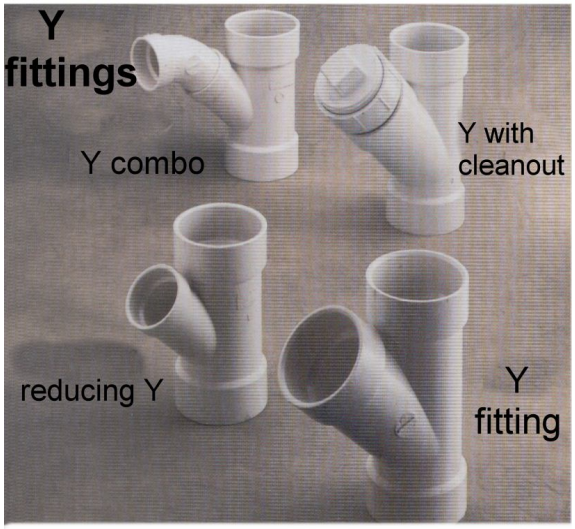


FIG. 8.31

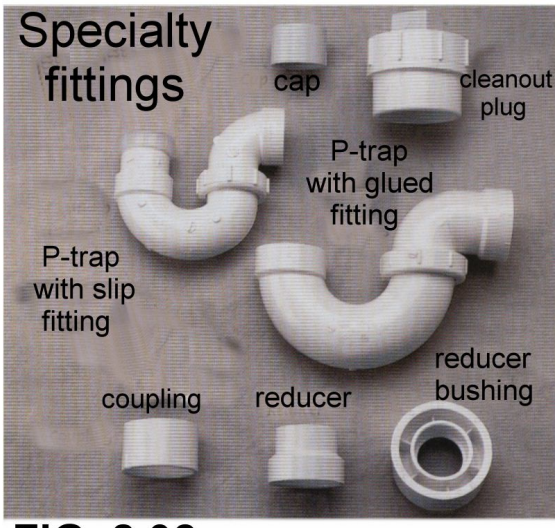


FIG. 8.32

There are many other kinds of fittings besides these, but we'll just focus on these right now. First off, you don't want to mix and match PVC and ABS. They aren't the same material and they each use a different kind of solvent cement. There are several different variations of fittings because they do different things.

An elbow is either a vent elbow or a wastewater elbow. The difference is that the vent has a short turn radius and the water has a long turn radius. Air goes around corners easier than water. Vent pipes can be 1 1/2 inches, but pipes carrying wastewater (washing machine, sinks, dishwashers, and baths/showers), need to be 2-inch lines. Soil pipes are those carrying solids so they need to be at least 3-inch lines. That is the difference in the sizes and the turn radius of pipes and fittings. Now let's put it all together to see what they do. **See figure 8.33**

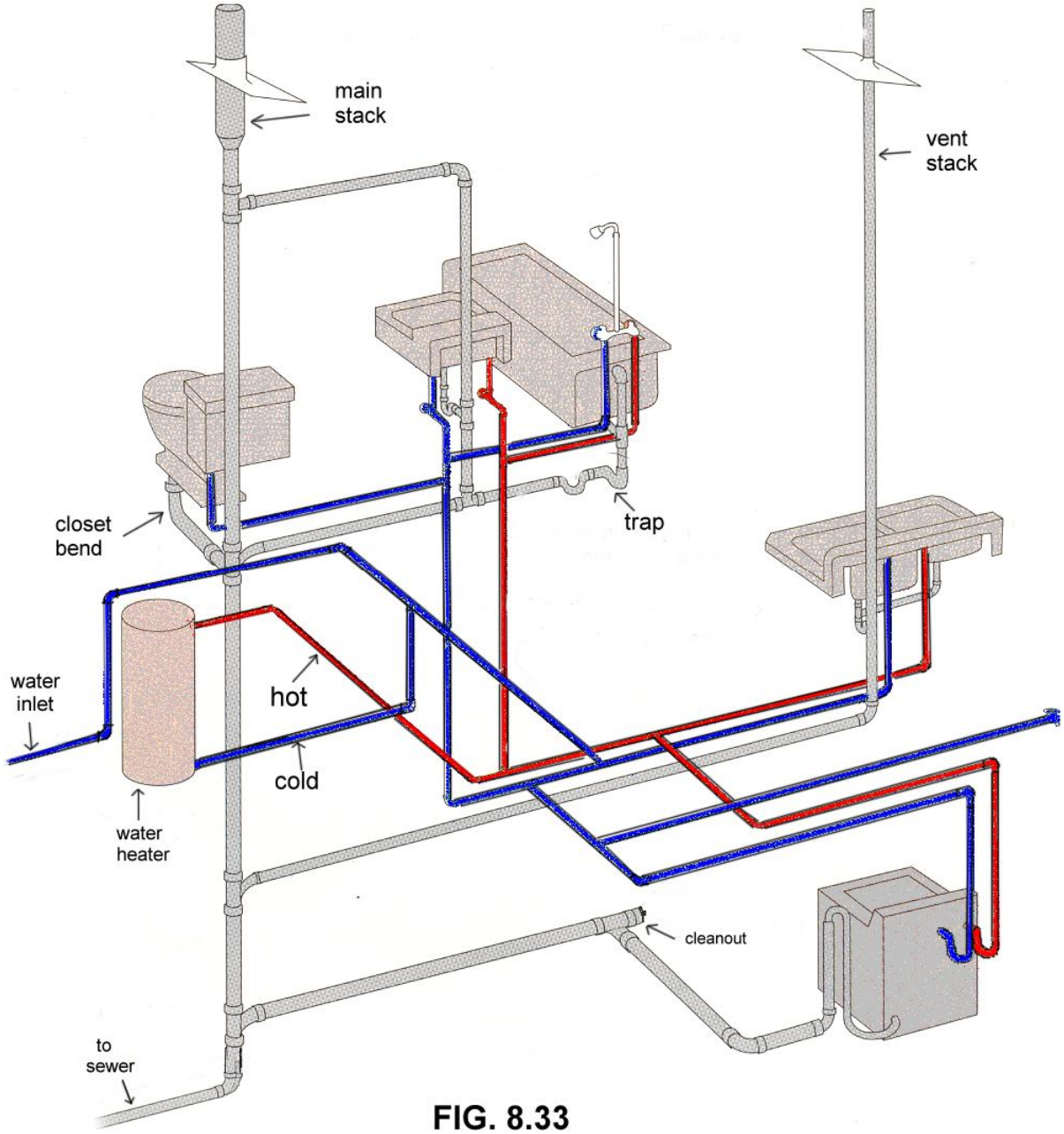


FIG. 8.33

When installing the septic lines, it's easier to start from the end and work your way forward. The best place to start is where your septic mainline enters the house. **See figure 8.34**. From that point, the line is probably a 4-inch pipe that needs a Y with a cleanout. That's where I will start the process and proceed by the numbers.

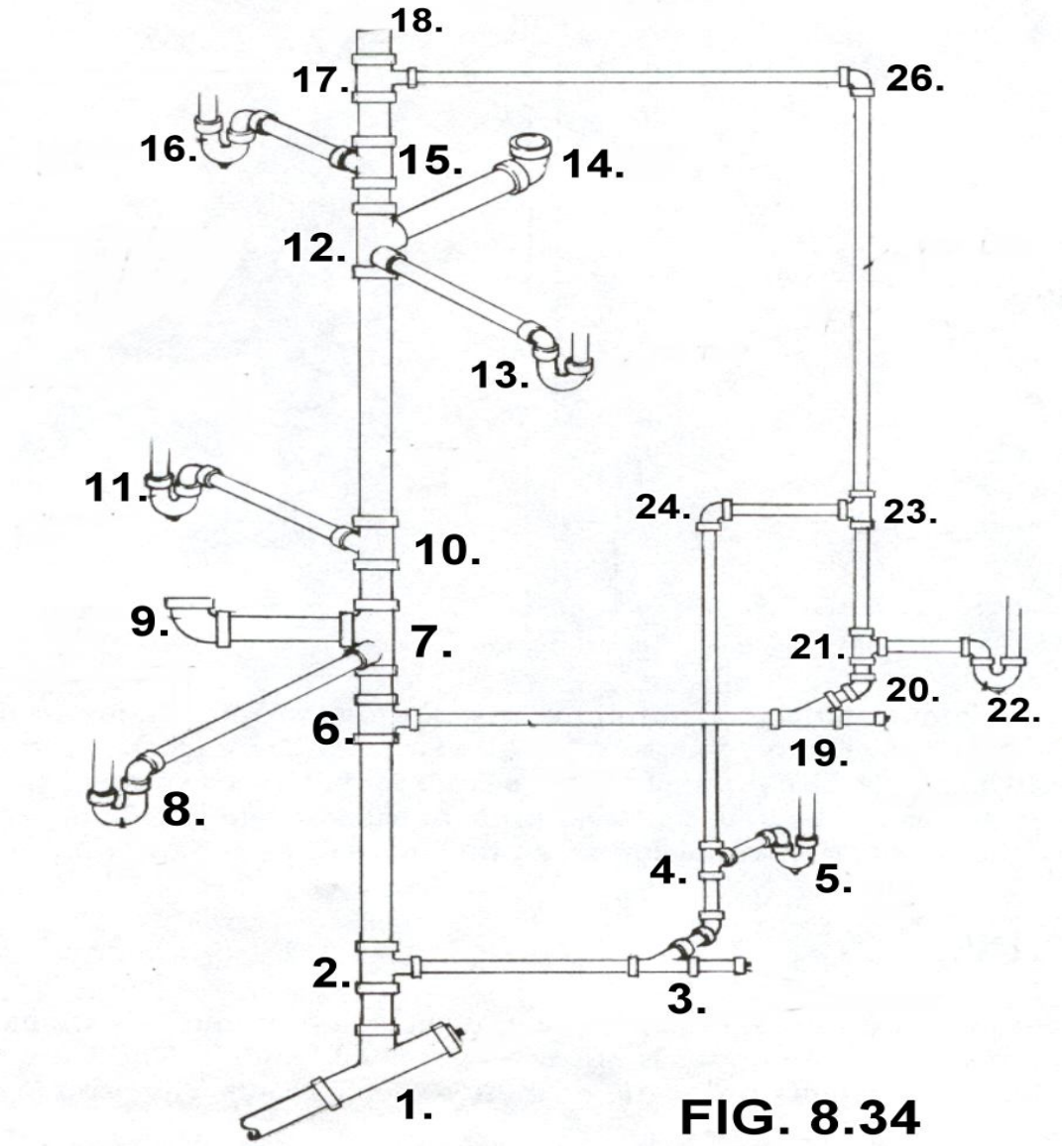


FIG. 8.34

1. From mainline, install Y with cleanout and plug, go up with 3-inch PVC pipe.
2. Install 3-inch reducing Y into main waste stack for 1st floor wastewater fixtures.
3. Put in 2-inch PVC with 2-inch Y with cleanout. Add long radius elbow.
4. Install a 2-inch T for sink wastewater and vent can be 1 ½ inch to vent line.
5. Install 2-inch sink trap usually with slip fittings to hook up to sink drain.
6. Put 3-inch reducing Y into main stack with 2-inch reducer for sink or washer.
7. Install waste T with side inlet for closet bend and sink wastewater.

8. Install 2-inch trap for shower/bath or sink.
9. Put in 3-inch closet bend for the toilet install.
10. Install 3-inch reducing T into main waste stack for lavatory trap access.
11. Put in 2-inch lavatory trap.
12. Continue stack to the 2nd floor where you will install 3-inch waste T with reducer.
13. Install PVC wastewater pipe and bath/shower trap on 2nd floor.
14. Put in closet bend for 2nd floor toilet.
15. Put 3-inch reducing T into main stack. Reducer will be for sink, bath, or washer.
16. Put in trap for sink, bath, or washer.
17. Put final 3-inch reducing T into main waste stack. Reducer can be 1 ½ for vent.
18. Main waste stack continues up through the roof.
19. Install the 2-inch Y with cleanout back into the stack for sink wastewater.
20. Put 22-½ degree elbow for wastewater to flow smoothly into Y.
21. Install 2-inch waste T for access to sink and vent.
22. Install 2-inch sink trap.
23. Install vent T. Can be either 2-inch or 1 ½ inches for venting.
24. Put in vent elbow and run line back down to 2-inch T wastewater fitting.

You can assemble the parts anyway you want. It's not difficult. There are a few rules about venting however. Many locations don't allow, "wet venting". This is where a vent pipe running horizontally carries water for a distance greater than normal. The example in **figure 8.34**, has 2 cases of wet venting so you can better understand what this means. The bath/shower in number **8,** and the lavatory in number **11** are mild cases of wet venting because the wastewater and the venting airflow are sharing the same pipe for about 5 or 6 feet. This could cause a problem with draining, so it should be remedied. **FIG. 8.35** shows how to solve the problem. **Figure 8.36** is a simple, but correct example of venting.

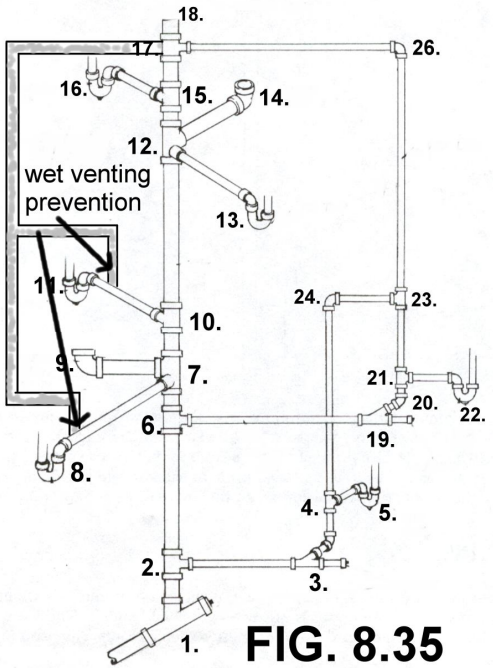


FIG. 8.35

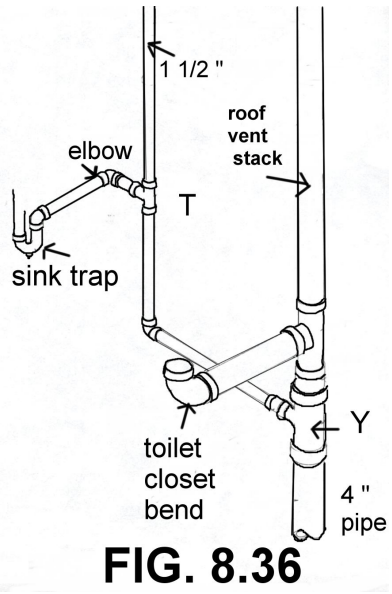


FIG. 8.36

A few decades ago, venting wasn't a major consideration and there was a lot of leniency in the area of wet venting. Trial and error has taken us down learning lane once again. If a vent is full of water or has restricted airflow, an imbalance in atmospheric pressure can suck the water out of traps and also prevent wastewater from draining. Take the time to make sure everything is properly vented.

Figure 8.37 shows a typical bathroom plumbed with galvanized pipe. Copper is exactly the same layout. This shows how things look after rough in. It helps to see the plumbing in respect to the walls and floor joists so we know how it should look. I did fail to mention the use of air chambers in metal plumbing to prevent noise. As in **figure 8.37**, the air chambers are pipes that extend about ten inches above the lavatory water line outlets. They create an air buffer to absorb rapid water movement that sometimes causes pipes to vibrate and jump. They could be a good idea. I don't really know much about galvanized pipe. Air chambers are a code requirement in a few areas only, but by and large, it is left up to the owner to decide.

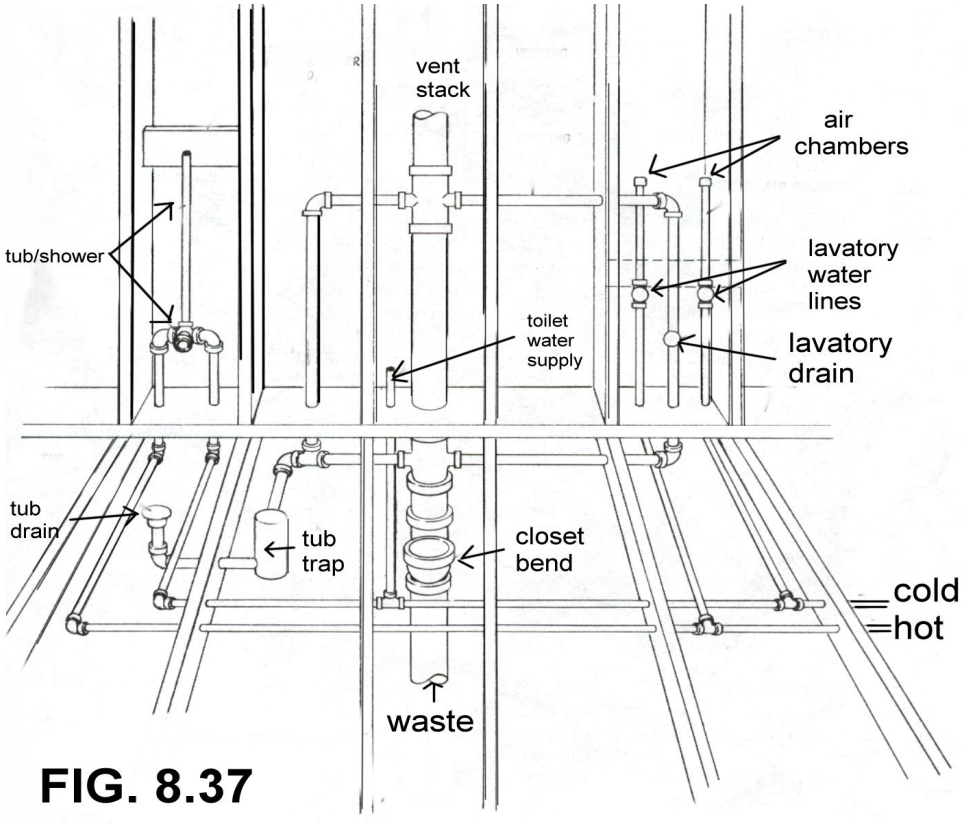


FIG. 8.37

There are only a few things left to cover about what to expect from plumbing. I didn't mention much about the slope ratios for waste lines. A person unfamiliar with the aspects of plumbing might think that down is down no matter the angle, but in truth, if the slope is too much on the waste lines, the water will run down and the solids will stay behind. Bad formula! The idea is for the angle to be just right so that the wastewater carries the solids away and out of our lives forever. That's why the codes will state something like having a ¼ inch slope every 12 feet of run. The inspectors are very particular about things like that.

Also, if you live in a cold climate zone, you may want to get frost bib spigots. They have a longer internal attachment that allows the spigot bearing to be closer to the warmer part of the house and not the exterior foundation. That can reduce the likelihood of frozen pipes through the spigots. You should have at least one spigot on each side of the house.

All other subjects regarding plumbing that include the fixtures; will be covered a little later on. There are a few procedures that require a fair amount of detail such as installing a toilet, or hooking up a water heater. These things will be explained in greater detail in some of the following chapters.

As for now, that should give us a general idea of what we need to do in the area of plumbing.

NINE

Electrical Wiring

Now this is where the fun really begins, but this is also where a lot of first time builders start to doubt themselves. I am going to start with the basics and move through the entire process, but I'll keep it very understandable at the same time.

Now, it's not my intention to discourage or frighten anyone from doing their own electrical work, but respect for Electricity needs to be observed and never put aside. Most of the time, you'll be working with 120-volt circuit runs, which have the power to give you a bad jolt or maybe even stop your heart causing death in rare cases. The circuit runs that are not as forgiving are 240-volt lines. If you lose your respect for these lines at any time, you stand a good chance of finalizing your life insurance policy. There is no reason at any time to be working on a live circuit, especially a 240-volt line.

There are detailed instructions available from the NEC (National Electrical Code) that can be used as a basic guideline for all residential wiring, but local codes from the Building inspectors and Electrical Inspectors always take priority over national codes. Local Electrical Inspectors are a very good source of information because they are the ones holding up the hoops we all have to jump through. In all honesty, I am very glad I was forced to jump through a lot of hoops from my inspectors, although at the time I was really bent. When I sleep at night, I know the fuses and circuits and wires aren't overloaded because that inspector made me tear them out and redo them, -----twice.

Let's get started from the beginning assuming that you are still using the temporary power hook up the utility company rigged up for you. It's been a struggle with only a few outlets to do all the sawing with. Now it's time for some real power! The utility company will put up the meter and base. Everything after that or rather, the lines going to the service panel and all the circuitry and fuses are the homeowners' responsibility.

Let's start out by first making a plan where we want everything to be located. It is a good idea to decide where to put the service panel. The Electrical Inspector will have some advice on this matter. There are specific requirements that can't be compromised. The service panel will be on the inside of the house and will hold all the fuses. All the circuit wires will be connected to it. The service panel needs to be close (usually within a few feet) to the service entrance or meter on the outside wall of the house. The service panel will have to be a specific height and distance from the floor. Also, the meter will need to be accessible for the power company. This means that wherever the service entrance is on the outside of the house, the service panel on the inside of the house will have to be just about on the other side of the wall.

So don't put a living room there on that side of the house because a breaker box makes for a poor conversation piece while entertaining guests. A garage or utility room would be a better option to house the service panel box. The Electrical Inspector will help you with the details for the service panel placement. **Figure 9.1** shows a service entrance and meter with an overhead supply. This helps show the proximity between the service entrance outside and the service panel inside. The utility company will wire the service

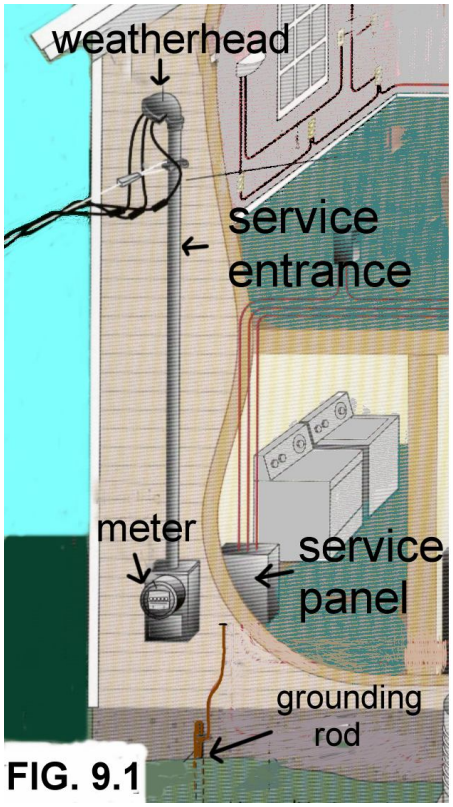


FIG. 9.1


FIG. 9.2


FIG. 9.3

usually to the meter, then from the meter, you run heavy gauge cables through the wall into the service panel box and connect them to the hot terminal bus. The type of cable used from the meter to the service panel is something like #000 Aluminum rated at about 200 amps, and there are usually 3 of them providing enough current for a 200-amp service. **Figure 9.2** shows a typical type of electrical service cable used in residential dwellings. This will usually have a black covering. **Figure 9.3** shows a service panel that is commonly used. It is also known as a "breaker box", or a "load center".

When considering a service panel, the minimum requirement that I would recommend would be a 200-amp, 40-slot load center. The higher amperage rating is a code requirement in most parts, but the slots for breakers is often left up to the electrician. An owner/builder might be tempted to opt for a smaller and cheaper service panel with fewer slots, but inspectors are becoming real sticklers on dedicated electrical circuits.

There are many new code regulations that didn't used to exist so one needs to plan for the future.

So now that we know what the service entrance, the meter, and the service panel are, let's get them all wired together. You can get the wire at an electrical wholesale store. You will connect all the wiring and have to pass your first inspection before the Electrical Inspector will give the utility company permission to connect the power. That's a good thing anyway, because you will be working with two 120-volt cables and a neutral cable, three wires in all. They won't be energized until everything is sealed up and secured.

Figure 9.4 illustrates how the 3-wire service leaves the meter and ends up inside the service panel box. The 2 black wires are then connected to the hot bus, and the white or neutral is connected to the neutral bus as shown in **figure 9.5**.

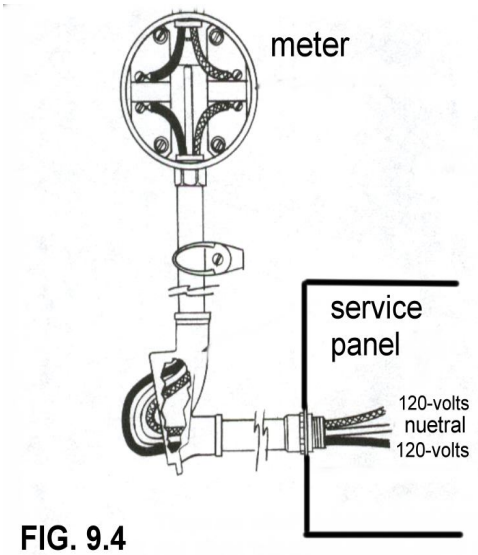


FIG. 9.4

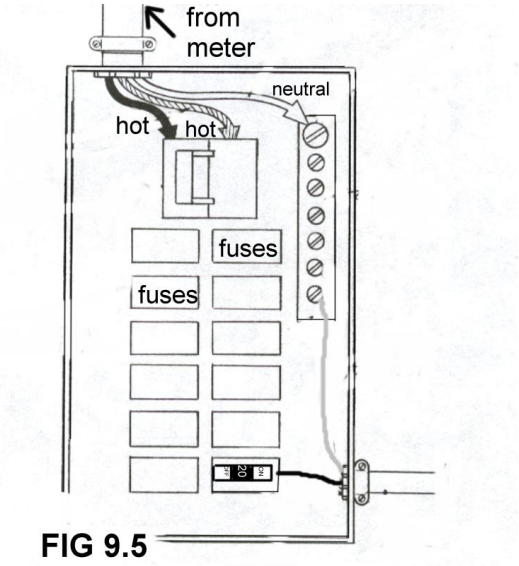


FIG 9.5

There are special conduit fittings available at most electrical wholesale stores that make the job look more professional and also help keep moisture out. You can use either a hole saw or a large spade bit to make the hole in the wall for the power cables. Once the power service from the meter and the service panel box are connected, then you will need to run a system ground wire to a grounding rod. The grounding wire is just a copper wire made for that purpose. It attaches to a grounding screw usually at the bottom of the neutral bus. The copper line typically exits through the side of the house toward the bottom and attaches to the grounding rod or the plumbing if metal pipes are used. Grounding rods are about 4 feet long and made of copper. They can be hammered in close to the foundation. If you look at **figure 9.1**, you can get an idea how it's done.

Your service panel box or breaker box will hold all the breakers or fuses and every circuit run in the house will begin at the breaker. See **figure 9.6**. The hot lines are either black or red wires. Each circuit run begins with a hot line (black or red) connected to the breaker, a neutral line (usually white) connected to the neutral bus bar, and a ground wire (bare copper) also attached to the neutral bus bar. From there, it goes out of the breaker box and on to the first outlet, (receptacle) or switch, (lights) or hard-wired appliance (water heater, electric wall heaters and heat pumps).

The breaker box has removable round tabs on all four sides giving access to the wiring. Romex is a common name for cable and one I use frequently. It's important to note that when a cable enters the service panel, the hole needs to have a fastener or clamp to prevent the metal box from possibly cutting the wires. **Figure 9.7** shows some examples.

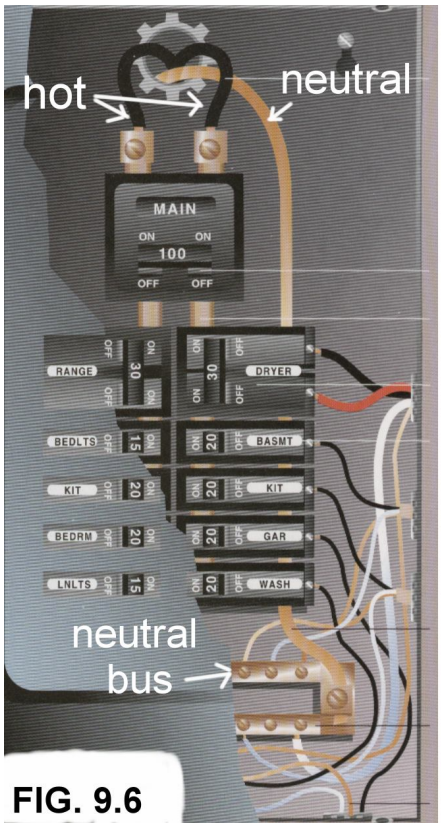


FIG. 9.6

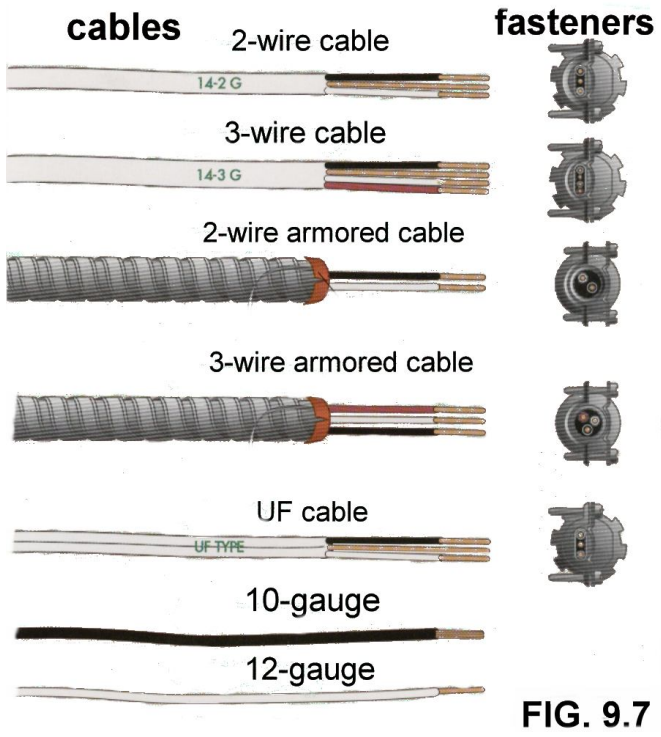


FIG. 9.7

This should give us a good idea how the breaker box is put together. From this point, it's a matter of laying out the many circuits and mapping them throughout the house. The dedicated circuits will be the easiest to map out because the entire circuit goes to just one appliance such as the range, or the water heater, or the clothes dryer to name a few. These are all power hogs and not only do they need their own dedicated circuit, but they also use higher amperage breakers and heavier gauge wiring.

There are two kinds of voltages used in residential dwellings, 120-volt for lights and small appliance outlets, and 240-volt for larger appliances. The breakers determine the difference between the two voltages. A 120-volt breaker is narrow and only attaches to one hot bus in the service panel. That gives it 120 volts of electricity. The big gnarly 240-volt breakers however, are wide and cover both hot bus bars giving them all the electricity available, which is 240 volts. Check out **figure 9.6** again and notice the difference in widths between breakers. Also, the larger appliances have varying levels of electrical current needs, so the breakers are also available in different amperage ratings. Let's make a couple of charts with the symbols and numbers we will need to lay out a good electrical floor plan from this point. **Figure 9.8** shows us some standard symbols.

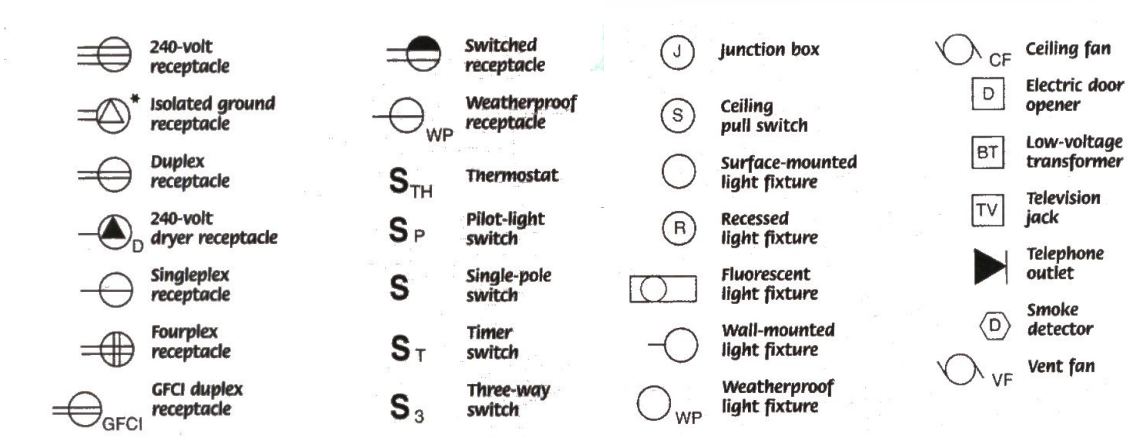


FIG. 9.8

These are the symbols used for an electrical floor plan to show the inspector. It also helps to keep things organized on paper. **Figure 9.10** shows a useful chart of appliances along with the size of wire, size of breaker, voltage requirements, and the required receptacle.

Appliance	Voltage	Wire size	Receptacle
Electric dryer	120/240V 20 to 30 amps	#10	30-Amp 120/240V
Electric water heater	240V 20 to 30 amps	#10	30-Amp 120/240V or 30-Amp 240V
Electric range	120/240V 50 amps	Two #6 hot wires and a #8 neutral wire	30-Amp 120/240V or 50-Amp 120/240V
Separate oven and cooktop	120/240V 30 amps separate 50 amps together	seperate 30-Amp circuits use #10 wire	50-Amp 120/240V or 30-Amp 120/240V
Refrigerator	120V 20 amps	#12	20-Amp 120V

FIG. 9.10

Almost everything else in the house will use a 120-volt, 20-amp circuit. If you have electric heat, you will need to find out the specifications on voltage and amperage because some heaters use 120 volts and others use 240 volts. Usually the higher voltage heaters run more efficiently.

It helps to make a top view of the electrical floor plan with the different symbols. It may look like a mess at first because there are so many symbols in such a small area to work with on paper, but you'll get used to seeing and understanding the diagrams and blueprints long before you begin construction on the actual circuitry. **Figure 9.11** shows a simple electrical floor plan with outlets, switches, and lights. I found it useful to make several copies of the same floor plan without all the electrical symbols, and then make an overlay diagram of each electrical circuit starting with circuit number "1". You will need to number your circuit runs at the breaker box anyway, so this is a good time plan it out. On each plan, include only one circuit run even if it is just your water heater or cooking range. Draw the circuitry exactly how it will run through the walls and joists and even include measurements in the plans if you want to. You might even want to laminate the plans because they will help you years later when you're trying to remember where you ran those darn wires. See **figure 9.12**.

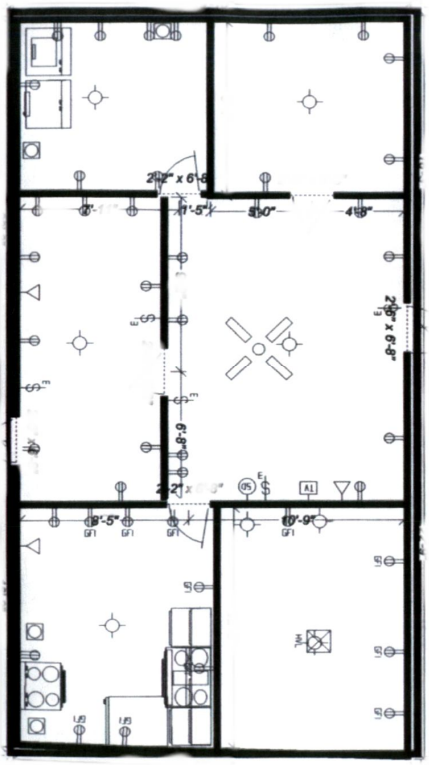


FIG. 9.11

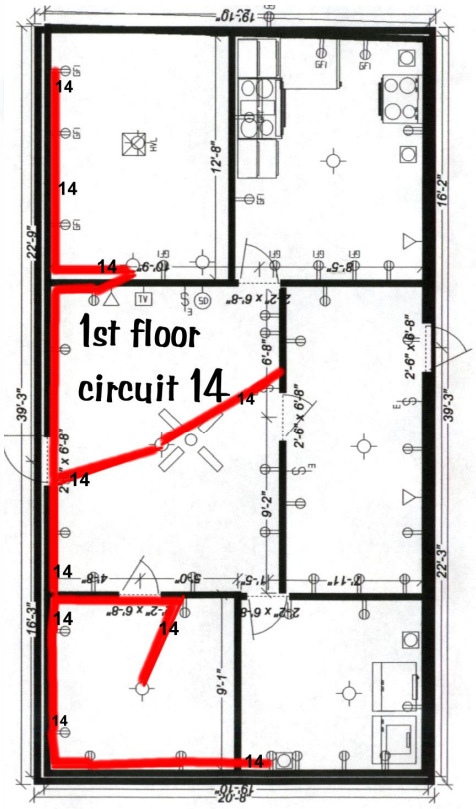


FIG. 9.12

The diagrams can be easy or complex because they aren't for anyone but you. The idea is to simplify something that is intimidating. That's the whole idea behind everything I stand for. If something is overwhelming and seemingly impossible to understand, step back a bit, scratch your head a few times, then break it down in your mind to the smallest steps or particles necessary. When you start to understand it at that level, then move on.

When planning your circuits, you will want to divide up the circuits with two major points in mind. First, and most important, is that you don't put too many loads on one line. That makes for hot wires and you'll wear your carpets out running back and forth resetting breakers. As a rule of thumb, you probably don't want to put any more than 15 loads on one circuit. A load is an outlet, appliance, or light switch. Both plugs on an outlet or receptacle are one load. This is one of those things that vary greatly from region to region so you'll need to consult your local codebook. That is one of the reasons you are going to need a large service panel box. Most residential dwellings will use around 30 breaker slots these days.
The second reason to divide up your circuit runs is to avoid total darkness when a breaker trips. Keep that in mind while planning circuit routes. Romex is cheap and it's easy to run, so try to at least integrate the lighting into several different circuits. In other words, don't run all your lights on one circuit.

Now, let's get started on the actual wiring. I like to put all the receptacle and switch boxes in first. These can be either plastic or metal depending mostly on the homeowners' choice, but in some locations, only metal boxes are allowed. See **figure 9. 13**. This also includes light boxes, or more often called junction boxes. **Figure 9.14**.

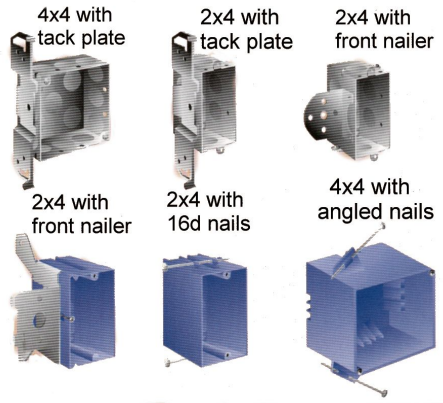


FIG. 9.13

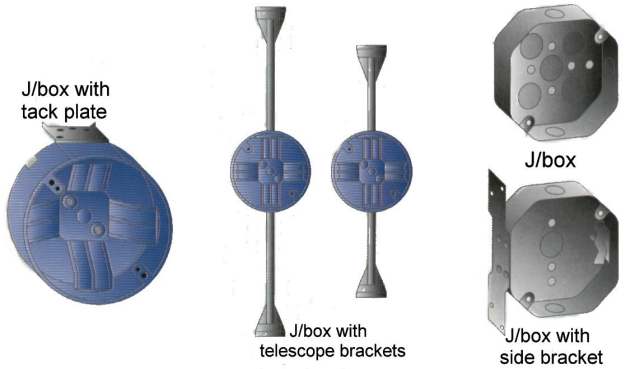


FIG. 9.14

These attach really easy. They have a sheetrock depth calibration already on them so you get a good accurate fit without having to measure. Most boxes can just be nailed in place. Every outlet, light switch, junction box, and even modern day phone jacks will need a box. You can get these boxes in many sizes depending on your needs. You will probably use a lot more boxes than you'd expect, but they're dirt-cheap.

It's important that each box is nailed evenly to the wall stud, but it's also important to make sure that the box extends beyond the stud evenly. See **figure 9.15**. If the nails are too tight on the top or the bottom, the plastic box will not be so square anymore. These are mistakes that aren't covered up by the finish work because the switches and outlets will appear slightly crooked when everything is done. Also, it's just a good idea to put a reinforced junction box in where every light will be. A bracket or telescoping rod seems like overkill at the time, but somewhere in the future either you or someone will want to put up a ceiling fan, a chandelier, or something heavy and it's much harder to reinforce a finished ceiling than to install a cheap $2.00 piece of metal while the ceiling is exposed.

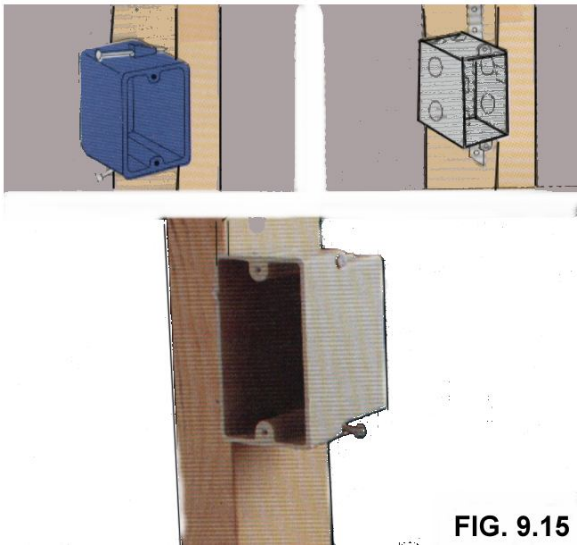


FIG. 9.15

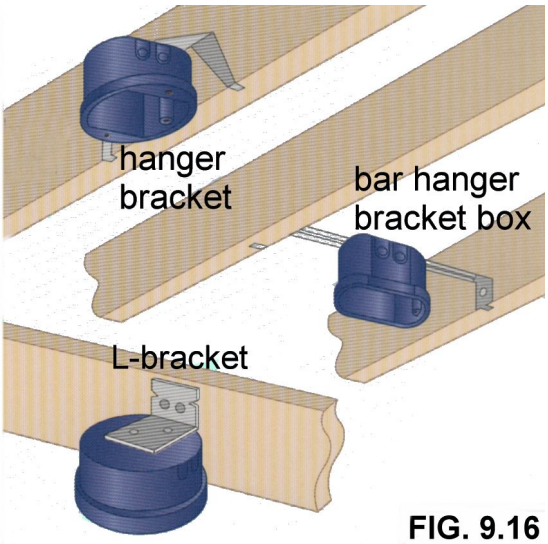


FIG. 9.16

The bar hanger junction box gives more support than a normal hanger bracket. See **figure 9.16**.

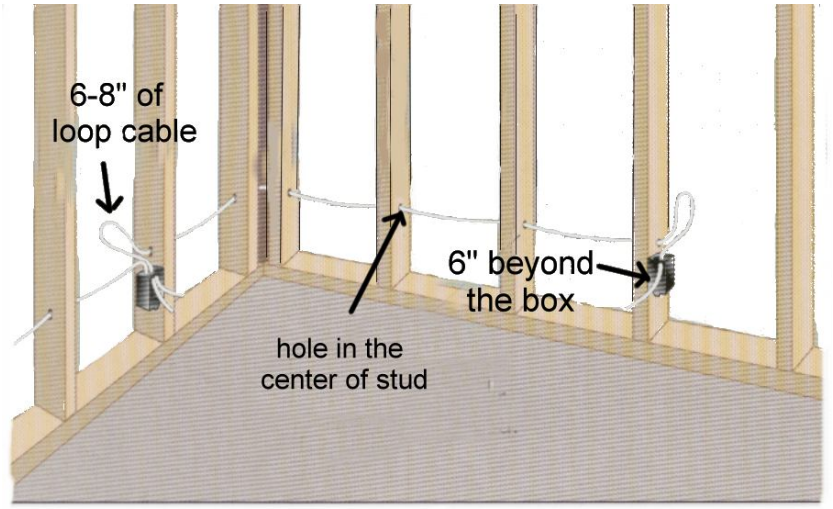


FIG. 9.17

Once the boxes are installed, the wires can be run from box to box as illustrated in **figure 9.17**.

You will need to leave extra wire for working with. It's always a good idea to leave an extra 6 to 8 inches of wire in a loop just above where the cable enters the box. This loop will allow for a margin of error when stripping wires. Try to drill all the holes in the studs at the same height to run the cable. Also, it's best to keep the hole centered in the stud to prevent finish nails or screws from penetrating the cable. See **figure 9.18**

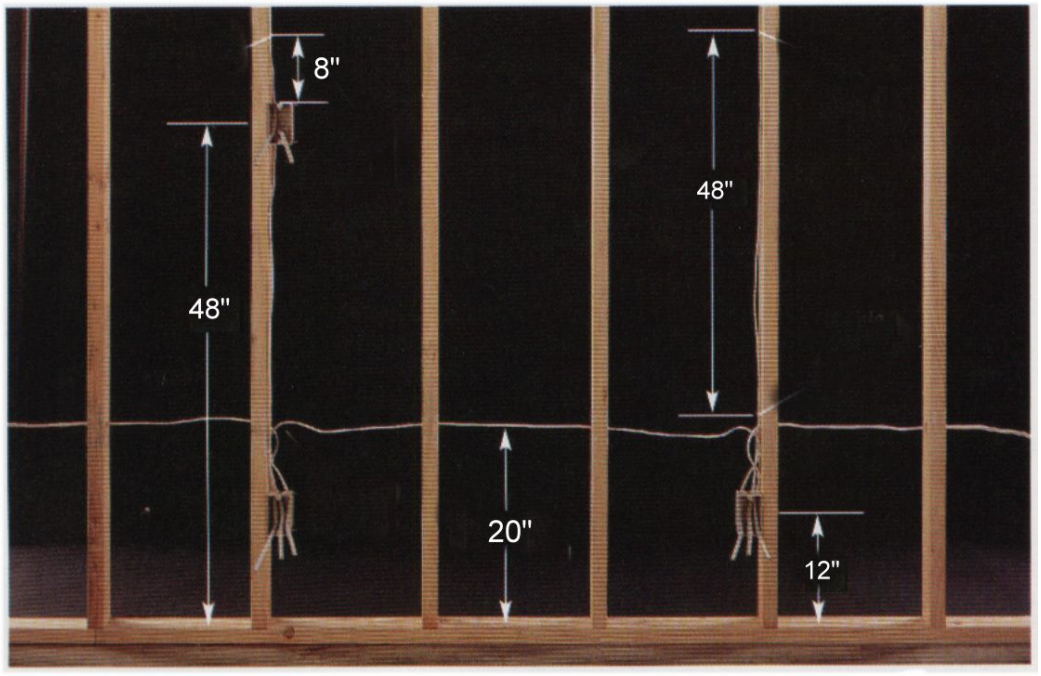


FIG. 9.18

. There are some code variations on just how much cable needs to protrude from the box to work with. Some say 6 inches, while others say 8 inches. If you're like me, you'll probably screw up all 8 inches at first and be fishing for the 8-inch loop you put, or should have put just above the box in the wall.

Prepping the wires for the receptacles and switches couldn't be easier if you have some good wire strippers. See **figure 9.19**.

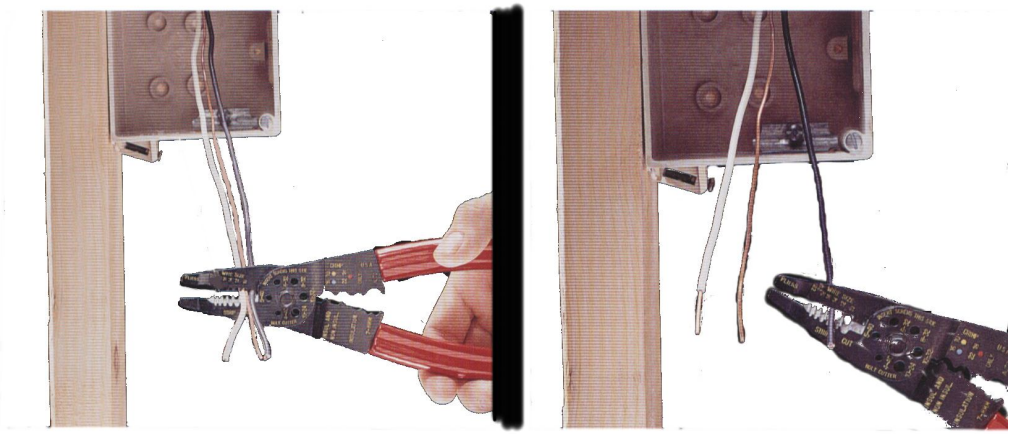
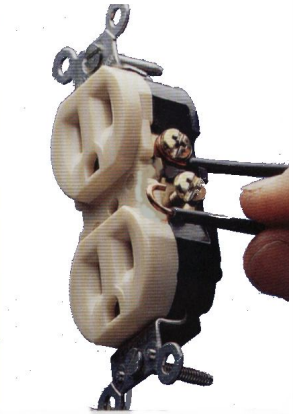


FIG. 9.19

You will need to strip about ¾ -inch off the wire and make a bend in the direction that the screw will turn on the receptacle or switch. See **figure 9.20**

FIG. 9.20



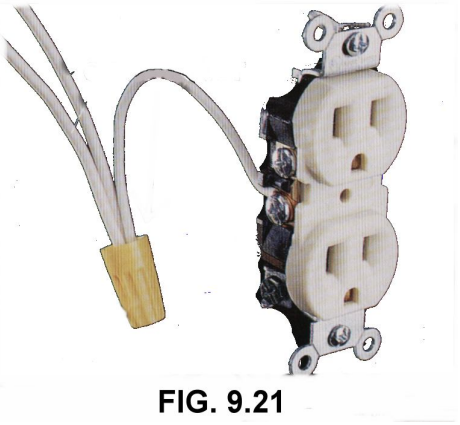


FIG. 9.21

Tighten down the screws really well. Most receptacles and switches have insertion fittings or holes on the back to put wires in. This gives more options, but seldom do electricians use the insertion fittings because it crowds the wires inside the box often causing wire connectors to come apart. Most electricians use the screws on the side of the receptacle.

This is an important point to remember before we get into the many different wiring combinations. If you're doing your own electrical work, you are an electrician because you will do everything according to a national standard. If someone comes a few years later and works on your electrical system, that person will assume that when he or she grabs a plain, white neutral wire, his or her hair won't get curled. That's because everybody follows code, or at least, is supposed to follow code. Personally, I keep my voltmeter handy when testing other systems. Black wires are hot. They are wired only to hot terminal screws or other black wires. Red wires are hot and are usually either a traveler wire (for 3-way switches), or an extra 120-volt line to double voltage for a 240-volt appliance. Red wires are also only wired to hot terminal screws and other red and black wires. White wires are neutral and are only wired to the neutral bus at the service panel, the neutral terminal screw on receptacles, or other white wires. Bare, copper wires and green wires are ground wires and they attach to other ground wires or can be terminated in metal boxes.

The basic cable used is Romex 12/2. This is just a non-metallic, sheathed cable of different sizes and number of wires inside. The size of wire is the gauge. That's the first number. The second number states the number of wires, which are 2. Actually, there are 3 wires if you count the ground wire, but nobody does. Also, a lot of 12/3 Romex will be used because it has an extra wire in it and it is required by most codes to be used where there are 3-way switches that need that extra wire called a traveler.

There is one exception to the color code rule that needs to be mentioned. In certain situations, such as in 3-way switches and dual control, dual light switches, even 12/3 cable falls one short of enough hot wires. In this case, it is legal to use a white wire as a hot wire only if the wire is painted or wrapped with black tape on both ends. This is very common. **Figure 9.22** shows two common types of cable.

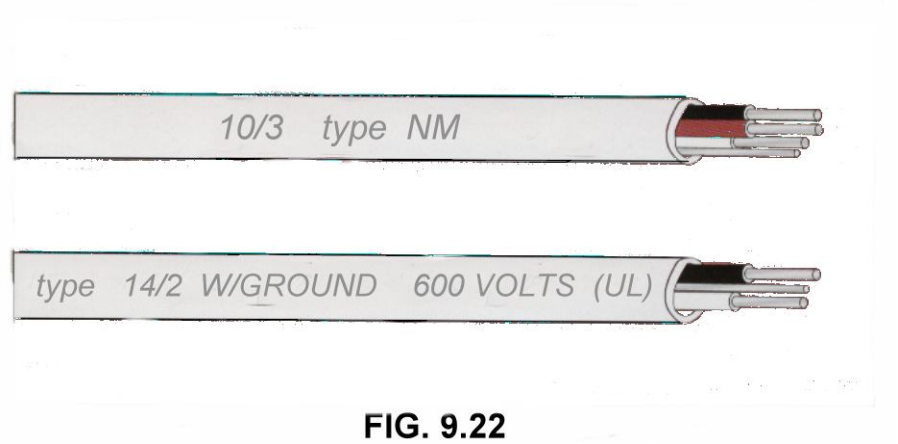


FIG. 9.22

Now that we have learned a few things about electrical wiring, it's a good time to get into the thick of the installation methods and to also show many kinds of wiring diagrams. The easiest way to get started on the actual wire installation is to nail all the electrical boxes in place. These are the boxes for all outlet receptacles, light switches, ceiling light boxes, and junction boxes which include phone and TV cable outlets as well. After all the boxes are in place, the wiring is a simple matter of running the cable from box to box. Remember, cable is quite inexpensive, so try to make the cable runs look neat and organized even if you have to use a lot of extra cable. Use staples to fasten loose or hanging cable. **Figure 9.18** shows the height requirements for receptacles and light switches. You will use standard 12/2 and 12/3 Romex for all the 120-volt circuit runs. Some contractors still use 14/2 Romex for lighting. You will need to use 12/3 Romex for any 3-way light switches. A 3-way light switch is a light that can be turned on or off from more than one location. All 3-way switches need to be connected by a traveler wire that can only be found in 12/3 cable.

The circuits using more electricity will require different types of cable. These are special circuits that have strict codes to follow. You will need to get all local code information about these circuits because certain areas have different regulations. For now, we will follow the National Electrical Code regulations. Remember that local codes always take precedence over the national codes. The electrical inspector will be a wealth of knowledge in that area. Most inspectors have free material to give to ensure the guidelines are followed.

The electric water heater will be a dedicated circuit. A box won't be necessary because the cable will run directly from the service panel breaker to the connections inside of the water heater. You will probably also use number 10 cable with a 240-volt, double-pole, 30-Amp breaker See **figures 9.23**, **9.24,** and **9.25**. Number 10 cable is thicker than number 12 cable and is able to handle higher amperages without getting hot.

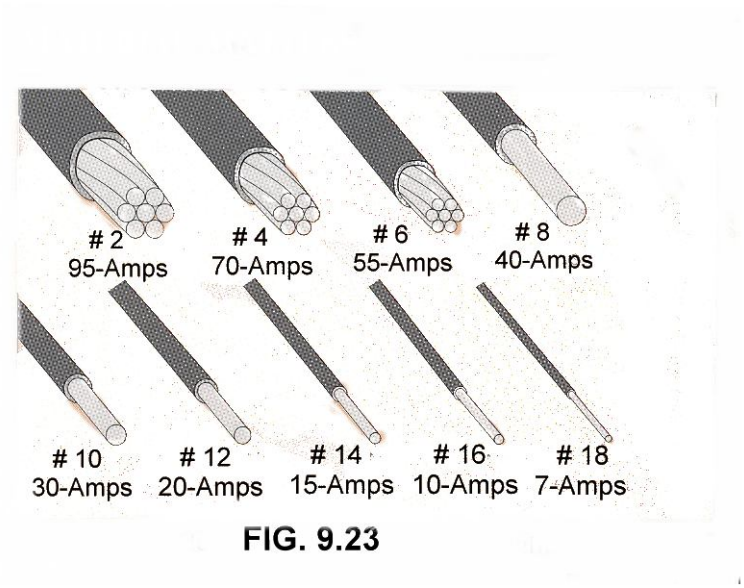


FIG. 9.23

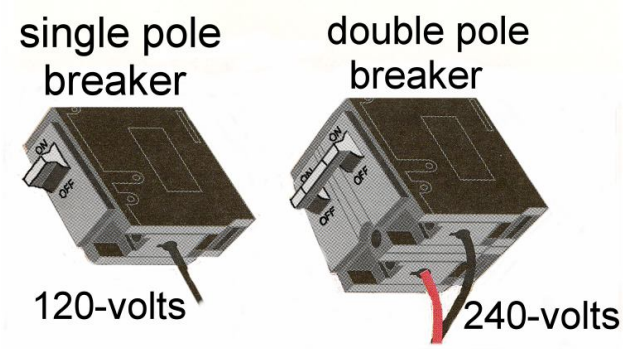


FIG. 9.24

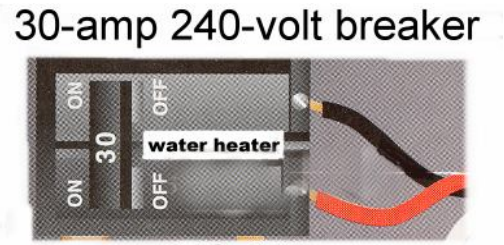


FIG. 9.25

Another circuit that requires special wiring is a clothes dryer. Like the water heater, it uses a dedicated line with a 30-amp, 240-volt, double pole breaker with 10/3 Romex. One thing to keep in mind here is that modern clothes dryers and ranges now use a four-wire plug. This is a simple matter of connecting the copper ground wire to the plug as well as the other three wires. Normally, the copper ground is attached to the dryer chassis. You can also get a special adapter plug that converts a three-wire plug to a four-wire plug. These adaptors are available at all appliance stores. Many local codes now require the extra wire because of the new plugs on all new appliances.

The one circuit that takes the most electricity is the oven/range. These vary quite a bit in the amount of wattages used, but as a standard, the oven/range has a dedicated circuit that uses a 50-amp, 240-volt breaker. The cable is usually two heavy six-gauge wires for the hot lines, and a six or eight-gauge wire for the neutral. It is called range cable. This cable also comes with a ground wire for four-wire plugs.

There are other 240-volt lines depending on the heating and air conditioning structures. Most heating circuits will require at least a 30-amp, 240-volt breaker. The size of cable is typically 10-gauge, but this depends greatly on the type of heating system and the manufacturers requirements. Air conditioning systems are the same.

These heavy current lines tie into the breaker box with only the hot lines attached to the breaker, the neutral and ground wires will attach to the neutral bus bar. See **figure 9.26**.

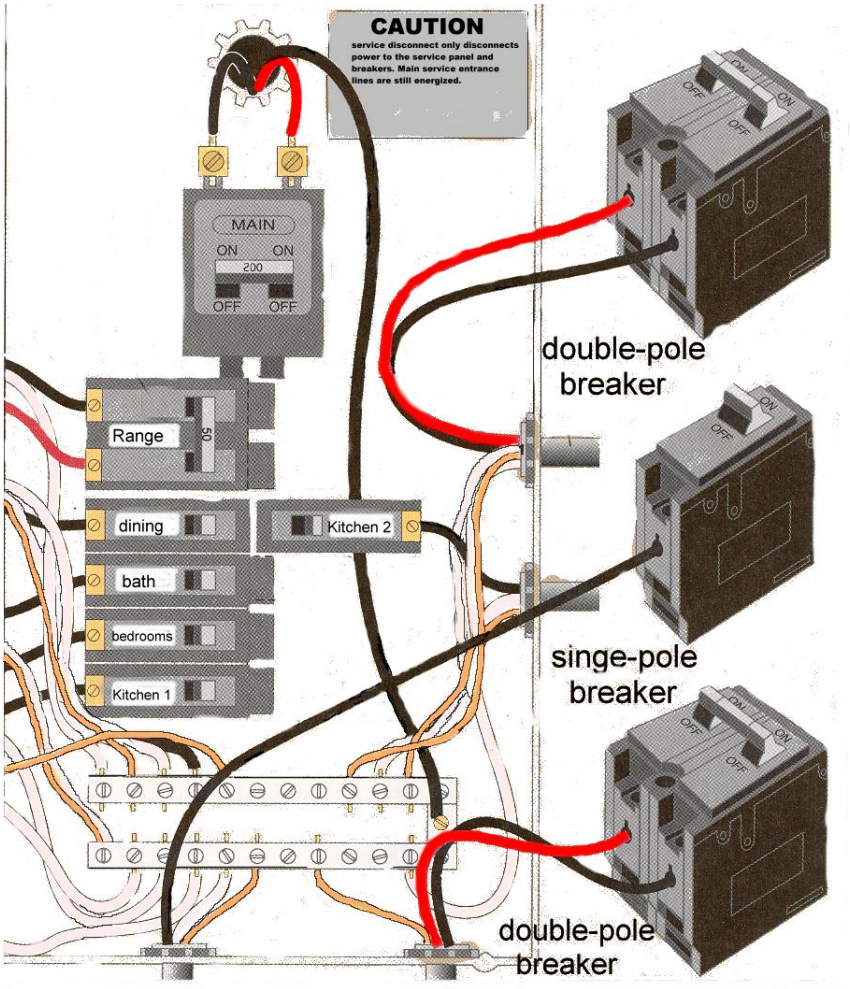


FIG. 9.26

The breakers just pop into place as they attach to the hot bus bars. You will need to label each breaker so you don't forget which circuit it is.

Now let's get into some circuit runs. We'll start with a plain outlet receptacle. Your local codes will indicate the number of minimum outlets each wall will need. I prefer to have a lot of outlets. In these modern times where we have computers, the peripherals for the computer like printers, scanners, speakers, monitors, and external drives can completely fill up one eight-slot surge protector with several things left to plug in. It's the same for TV/Stereo entertainment centers. Remember, outlet boxes and receptacles are very inexpensive so definitely put in plenty outlets. I thought I had gone way overboard by putting outlets about every eight feet. Still there are times when I could use another plug.

Figure 9.27 shows how to connect a plain receptacle in the middle of the circuit and at the end of a circuit run. In the middle of a circuit run, one cable comes into the box and one cable goes out of the box on to the next receptacle or switch. At the end of the run, there is just a cable coming into the box, so only one hot terminal and one neutral terminal screw is used. Hot terminal screws are usually brass colored and neutral terminal screws are silver. The ground wire attaches to a grounding screw that is usually green.

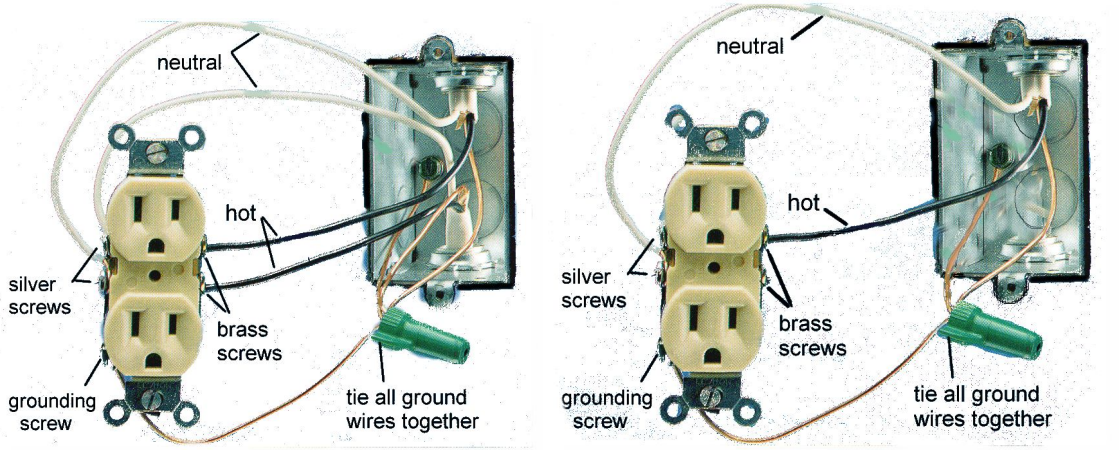


FIG. 9.27

You will have to use only GFCI (Ground Fault Circuit Interrupter) receptacles in the kitchen, bathrooms, and outside outlets. **Figure 9.28** shows how to connect a GFCI.

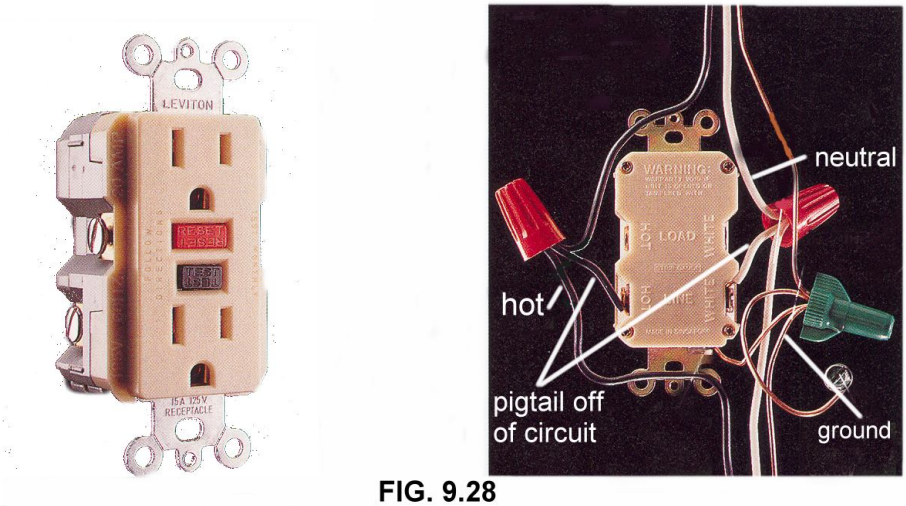


FIG. 9.28

You will want to wire the GFCI receptacles in a pigtail style and not in a continuous circuit like normal receptacles. You can wire GFCI receptacles like normal receptacles where you have both incoming and outgoing hot and neutral wires on each side, but if a GFCI trips, then everything after it on the circuit will be dead until the GFCI is reset. Not only that, but when you put too many loads on a GFCI, it will trip more often and you will be resetting it constantly. It's better to make a splice off of the circuit with wire nuts and have only one hot and one neutral going into the "line" terminals on each side. That is called a "pigtail".

Figure 9.29 shows a basic diagram of receptacle outlet wiring.

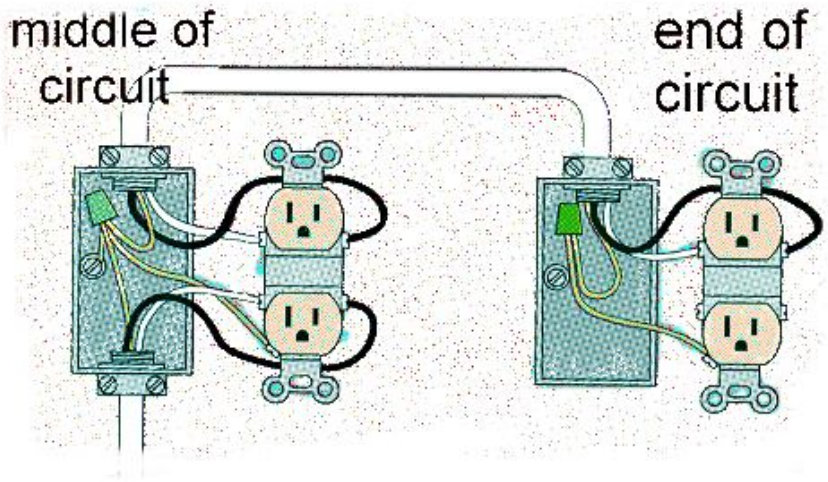


FIG. 9.29

Next, let's move on to the lighting. There are a few different kinds of light switches, but they all have one thing in common. A switch is just a voltage interrupter within the hot wires that either completes the circuit, or breaks it. **Figure 9.30** shows some of the basic light switches that are used frequently in residential construction.

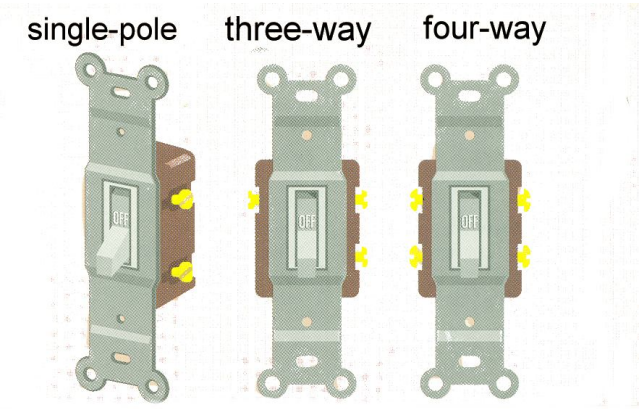


FIG. 9.30

Single-pole switches activate a light or lights, from only one location. Three-way switches activate a light or lights from two locations. Four-way switches activate a light or lights from more than two locations. They can get a little tricky, so the diagrams can really help out a lot. **Figure 9.31** shows a simple single pole light switch diagram with the switch before the light in the circuit run. **Figure 9.32** shows a single-pole with the switch behind the light. In this case, an extra hot wire is needed so it is legal to paint or wrap electricians' tape around both ends of the white wire.

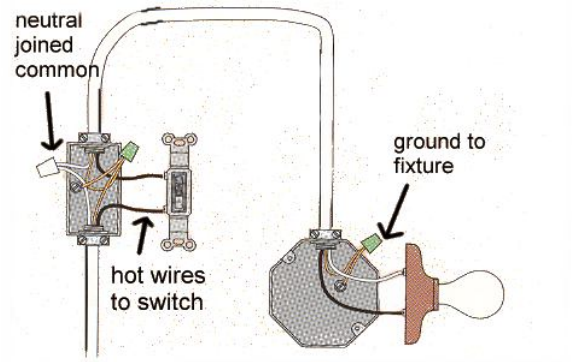


FIG. 9.31

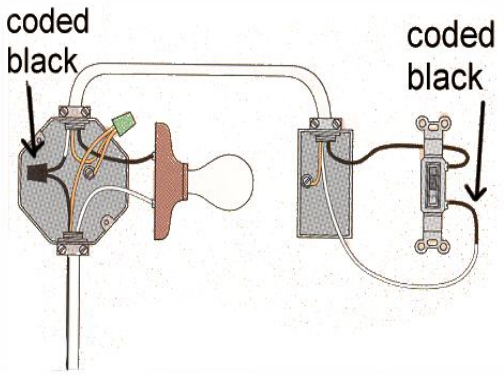


FIG. 9.32

Three-way switches are a little confusing at first, but after you look at the diagram and think it through, it'll make perfect sense. The easiest way for three-ways is to place the light between the two switches as shown in **figure 9.33**.

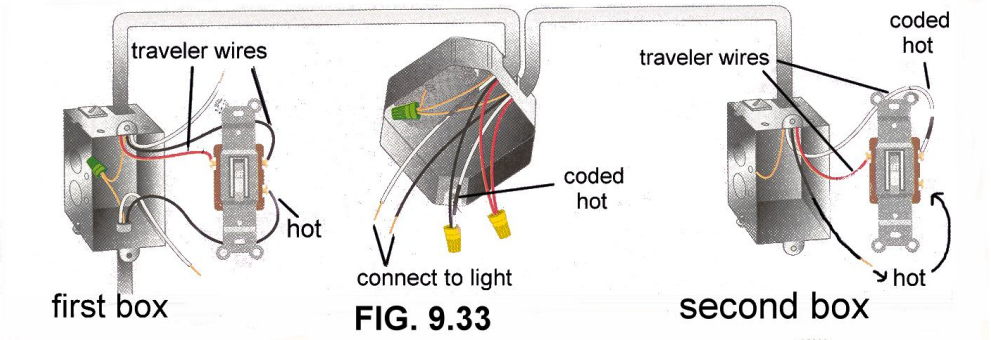


FIG. 9.33

Another way is to put the light at the end of the switches as in **figure 9.34**.

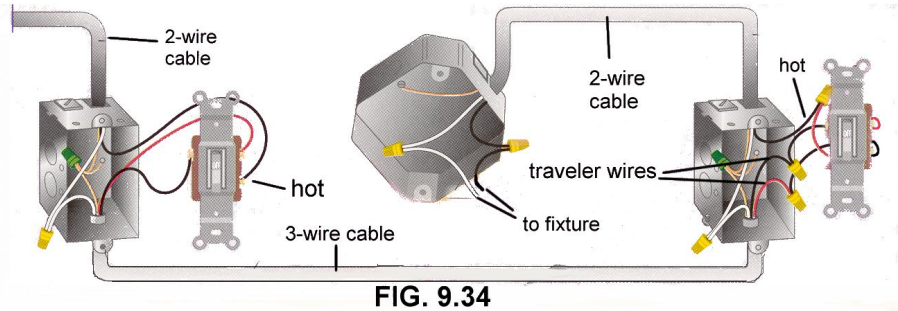


FIG. 9.34

Four-way switches sound confusing, but they are quite simple. Just remember this one thing: four-way switches are always between three-way switches. You can have one light that is controlled from a dozen locations, but you'll start with a three-way switch at the start of the light circuit, place ten four-ways in between, and then end with another three-way switch.

Many homes, especially those with garages, have lights controlled from many locations. You need to be able to turn the garage light on when you're entering from outside, or entering from upstairs, or downstairs into the garage. You will want to be able to turn the same light on or off from any surrounding part of the garage outside or inside. Any place where there is a doorway or entrance should have a light switch.

Three-way switches aren't really "three way" at all. They're only two-way if you consider that a light can only be controlled from two locations with three-way switches. I don't know where that word came from, but if you need to have a light controlled from three locations, you will need to start with a three-way, put a four-way in the middle, and end with another three-way. See **figure 9.35**.

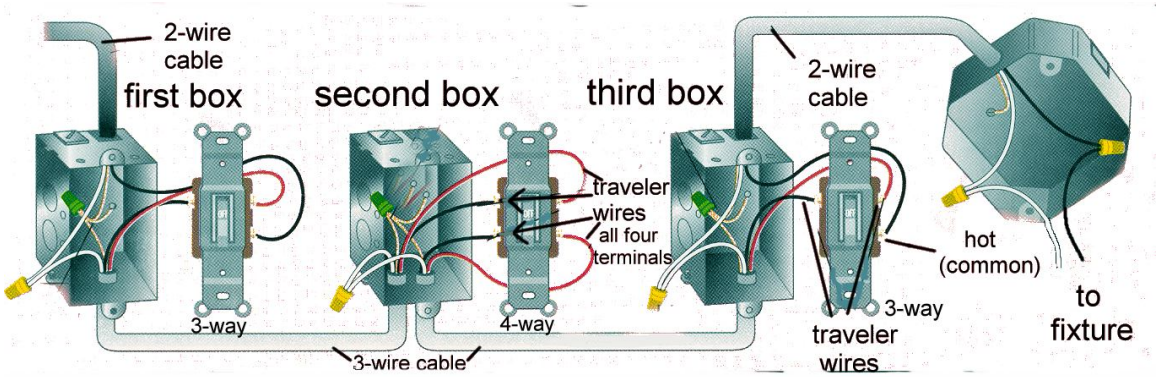


FIG. 9.35

Dedicated circuits are easier to run than lighting circuits because there isn't any branch circuitry. The dedicated circuits will require special wire and breakers. Each appliance will have a specific outlet or plug that will be used. The only appliance that has no outlet is the water heater. It will be hard-wired which means the cable will run from the wall directly into the water heater's own wiring box inside the water heater. Any cable that comes out of the wall through the sheetrock should be encased in flex conduit (BX Cable) or wire loom and fastened at each end from the wall to the appliance with cable fasteners or grommets.

Figure 9.36 shows the circuit run for a Range/Oven. The fuse is a 50-amp, 240-volt breaker. The cable is 6/3-Range cable. The outlet is a four-wire plug.

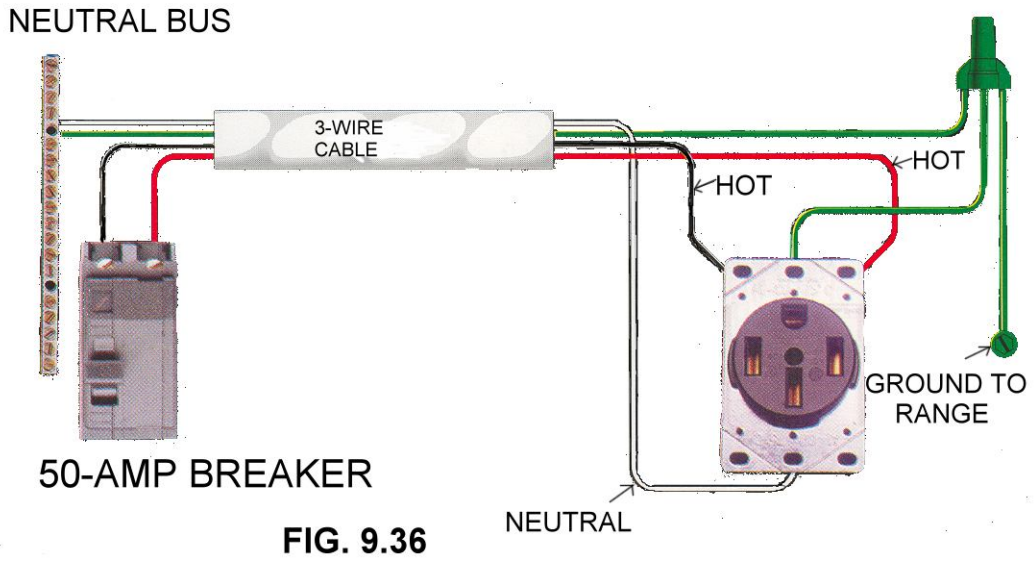


FIG. 9.36

All dedicated circuits will be similar to the Range/Oven circuit in the way they are run and connected to the breakers and the outlet plugs.

Now, let's take a look at low voltage wiring which is used mainly in doorbells, phone systems, and computer networks.
Doorbell wiring ties in to the electric circuitry of your home by means of a transformer that reduces voltage. The transformer will fit into a junction box just like a light or a switch. **Figure 9.37** shows a doorbell controlled from two locations. Usually the chime is different between the front and back so you know which door to answer. The 120-volt line goes into the transformer and usually two small lines go to each doorbell. The wires are usually about 18-guage and carry a voltage smaller than 12-volts. See **figure 9.38**.

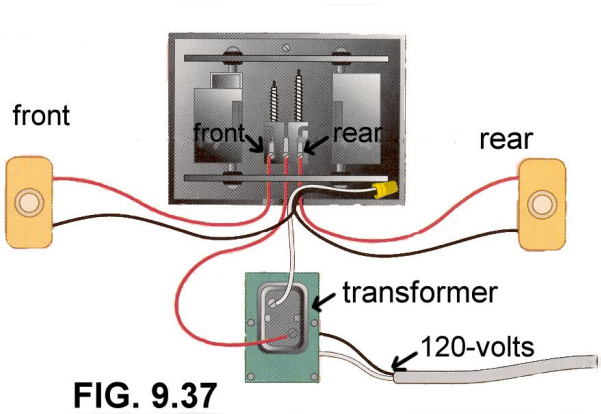


FIG. 9.37

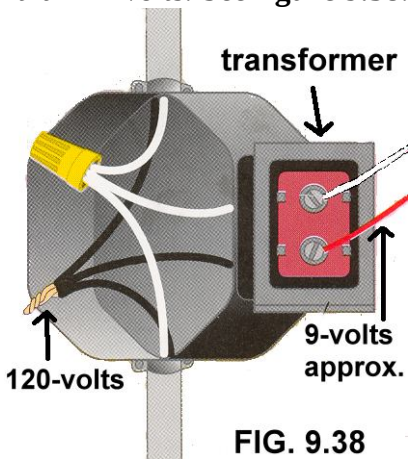


FIG. 9.38

The phone system is another low voltage line, except it isn't tied in to the electric circuitry of the home. The voltage comes from the phone company and is maintained by them. They will install service up to the box. This box is called a "Demarcation block" or just "D-marc block". To us homebuilders, it's just a box. From the box, we run our separate lines to each modular jack or phone jack. If you have multiple lines, you will have to map out a circuitry route just like the electrical circuits so you don't get confused. The modular jacks will fit into regular electric boxes.

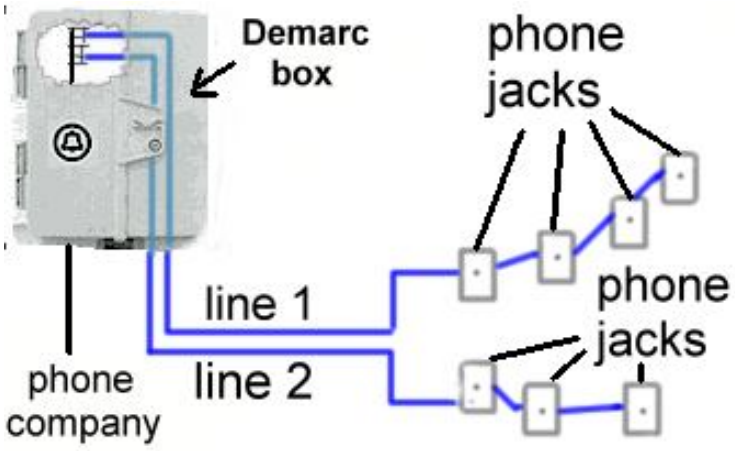


FIG. 9.39

Figure 9.39 shows a simple residential phone system with two phone lines. The phone company only runs service to the box. The homeowner then runs the wiring from the box, into the house, and on to the rooms in the house that will have phones in them. The above illustration is an example of a "Daisy chain" wiring method. This is an old way of doing things. The problem with a daisy chain is if one phone jack goes bad, all the ones behind it will stop working. A solution to this problem is called a "junction box", or a "star". It acts like a hub and each mod jack or phone jack will be wired separately and exclusively back to the junction box. It takes more cable, but is more reliable. See **figure 9.40**.

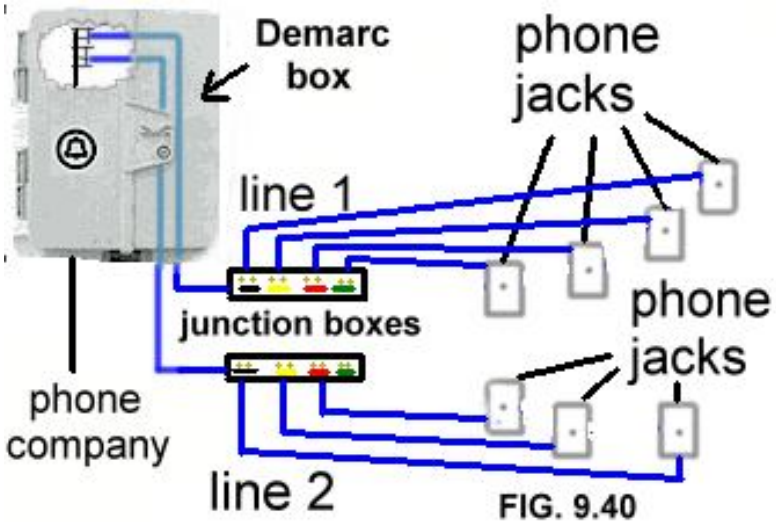


FIG. 9.40

Now that we can see how the circuit is laid out, we need to know what kind of cable to use. The most popular cable being used in residential as well as commercial dwellings is called “CAT 5” cabling. It stands for Category 5 cable, which was mostly used in network wiring because of its high data transfer capabilities, but was too expensive for home use. Now, it’s more reasonable in price and it is better for homes or businesses that will someday be expanding their communication needs. That is most of us if you consider the impact that computers have had on our communications systems over the past two decades. Besides, appraisers love to see “Data ports” in every room. It just says, “ I’m a modern, state-of-the-art home and I’m built with the future in mind”. That will boost the home’s value by thousands. No kidding.

Cat 5 cable is a plastic shielded cable with four twisted pairs of color-coded wires. See **figure 9.41**.

FIG. 9.41

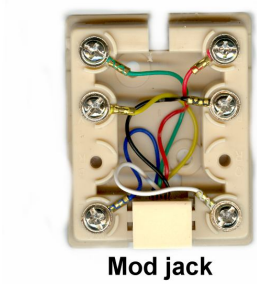


FIG. 9.42

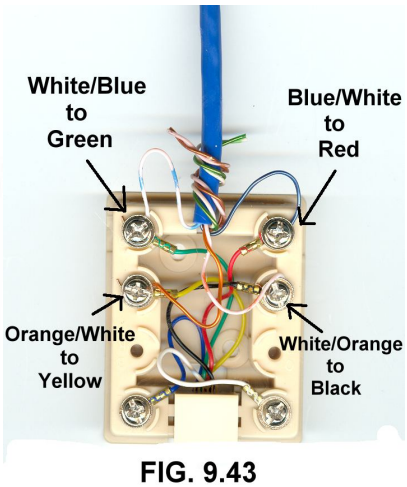


FIG. 9.43

The CAT5 cable is run just like the other electrical circuits. The cable will run to each room that will have a phone and it will have an outlet in the form of a wall plate or a flush mount mod jack. See **figure 9.42**. The cable will be wired to the RJ11 outlet or mod jack using the red-to-red, and green-to-green wires for the first line, and yellow-to-yellow, and black-to-black wires if you’re using regular phone cable. See **figure 9.43**. Just as a side note here, the CAT5 has eight cables, but not all wires need to be used. In fact, you only need two wires for each line, so as a rule of thumb you start out using the red and green wires or whatever color is close to those colors that you can remember. I say that because CAT5 varies in colors from manufacturer to manufacturer. The standard for wiring also varies between phone companies so you will get many different answers if you want the right one. The right answer is just this: be sure to use the same wiring order on both ends of the cable so that the phone lines actually work. You will want to use the same standard throughout the entire wiring though, that only makes sense.

Now, having said that, I will say that there is a vague industry standard that helps maintain some form of compatibility between old and new cable. See **figure 9.44**.

Telephone wiring color codes

4-wire	8-wire
Red	Blue/White
Green	White/Blue
Yellow	Orange/White
Black	White/Orange

FIG.9.44

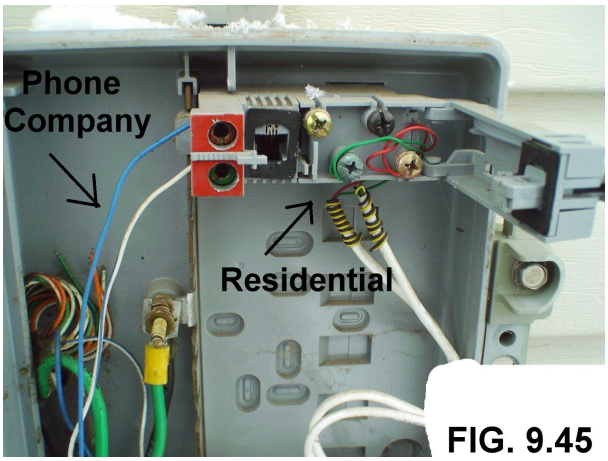


FIG. 9.45

You can see in **figure 9.45** that the phone company uses 8-wire cable, and many residential dwellings still use 4-wire cable. There might be certain local codes about which colors of wires go where, but they aren't strict like electrical codes.

If you decide to take advantage of the star idea instead of the daisy chain method, there will be one line of CAT5 that runs from the Telco box as shown in **figure 9.45**, to the junction box, **figure 9.46**. Just remember to have one line coming in from Telco, and then you can connect several mod jacks running from the hub.

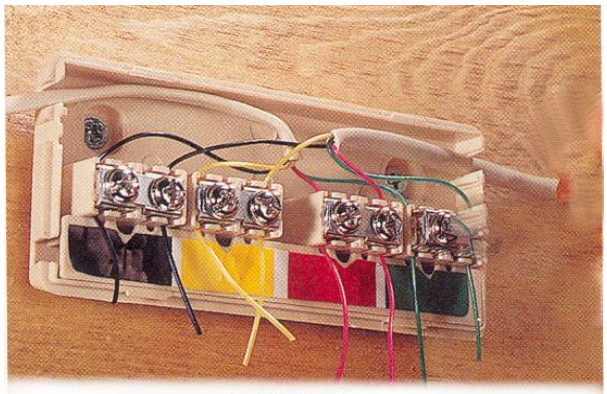


FIG. 9.46

FIG. 9.47

Now, let's move on to network wiring. It sounds complicated, but it's actually easier than phone system wiring. It's a good idea to put data ports in every room with the exception of bathrooms and storage rooms. **Figure 9.47** shows a data port with the wall plate attached. This is called an RJ45. Networks use CAT5 cable with a connection that is a little larger than a normal phone connection. A phone connection is an RJ11 and it will fit into an RJ45 port.

Networks are the same as phone lines in many respects. The old method for wiring networks as well as phone systems was in a daisy chain, that is, out of one computer into the next computer on down the line. The problem is when one computer goes down it pulls all the others behind it down also. It didn't take long to figure this one out. Almost all networks now use a Hub. This is where each data port is a dedicated line running back to the hub. Most modern homes are built with an accessible "Distribution Center". This is typically located near the breaker box. The only reason for this is just to keep the utility panels together as a matter of convenience. It's a good idea to have the distribution center contain all communication wiring. For example, I would put a junction box for the phone systems in there. Also, I would put a network hub and a TV hub for my coax cables. So all the CAT5, Coaxial cables, speaker wires, and intercom wires will start from the distribution center and then branch off to all the different rooms. See **figure 9.48**.

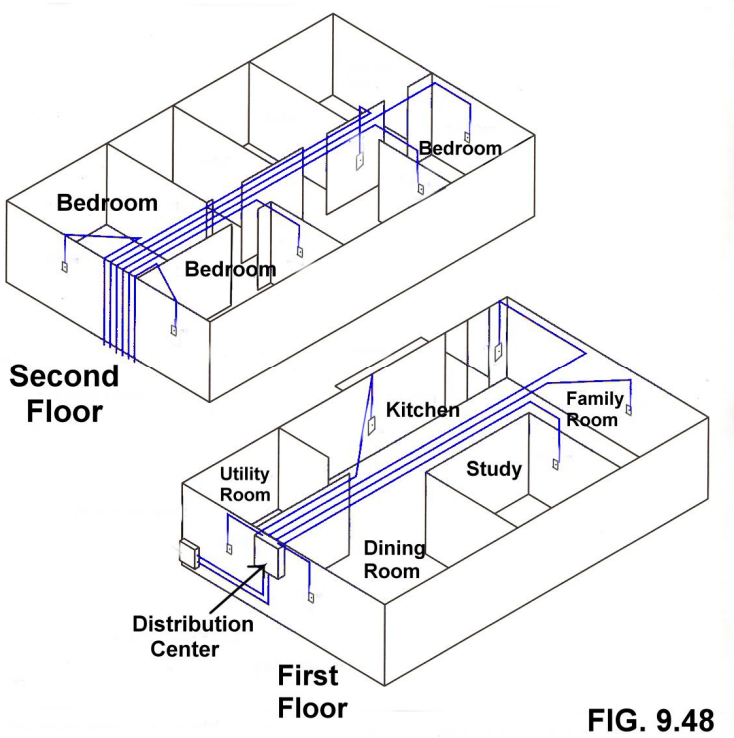


FIG. 9.48

It is always a good idea to run all the communication cables together. They're easier to manage that way and you can keep everything organized all in one strand. The terminations for the RJ45 connectors are color-coded making it easier to keep the wiring order consistent. The wires each fit into a slot that cuts through the plastic coating and make a solid connection with the copper wire inside. See **figure 9.49**.

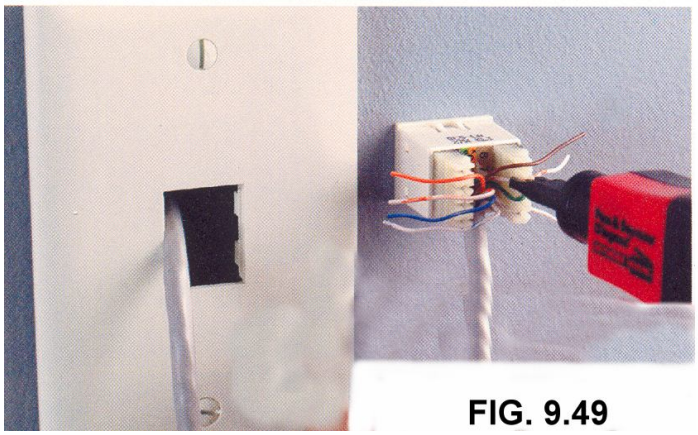
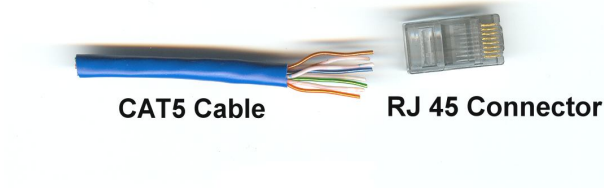
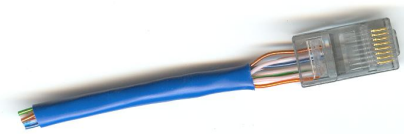
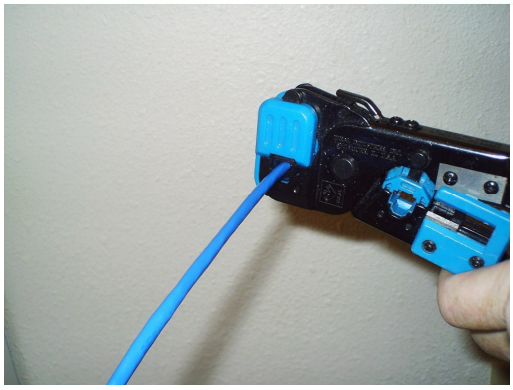


FIG. 9.49

You'll need a special tool for terminating RJ45 network cables. See figure 9.50







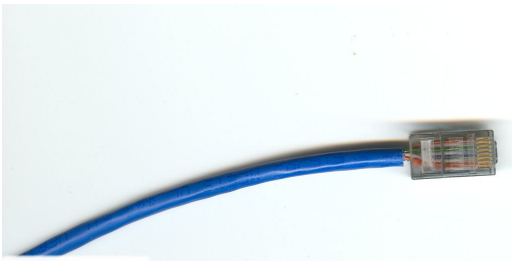


FIG. 9.50

Terminating CAT5 is really easy, but it takes a little practice. You'll want to cut the sheathing off about an inch down. Next, you will cut all the wires so they're even. There is a cutter on the crimper tool. After lining up the wires in the correct order, you take the connector and slide it over the wires with the tab down. They should each fit into each of the eight holes and you will be able to see if they're straight or if they're crossed anywhere. The crimper will have a slot for RJ-11 connectors and RJ-45 connectors. Slide it in the RJ-45 slot and crimp it down tight. There is a high potential of error when terminating CAT5, so you may want to buy or rent signal testers and test the cables before you close things up. See **figure 9.51**.

FIG. 9.51

Line testers will test all eight channels on RJ-45 connectors and they are also useful with regular phone line circuits.

Now, we'll move on to Coaxial cable. Coax cable for TV antenna comes in 3 standard sizes, RG-59, RG-6, and RG-11. Most homes use RG-59 because it's smaller and easier to work with. It's terminated with a fitting called an "F" connector. See **figure 9.52**.

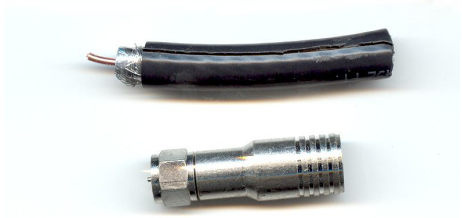


FIG. 9.52

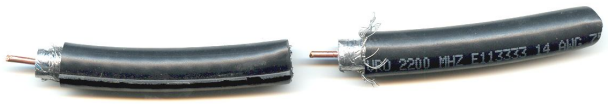


FIG. 9.53

The coax is shielded to prevent interference from higher voltage lines or fluorescent lights that might be too close. The coax needs to be trimmed and the shielding needs to be pulled back before the F-connector can be slid on and crimped. See **figure 9.53**.

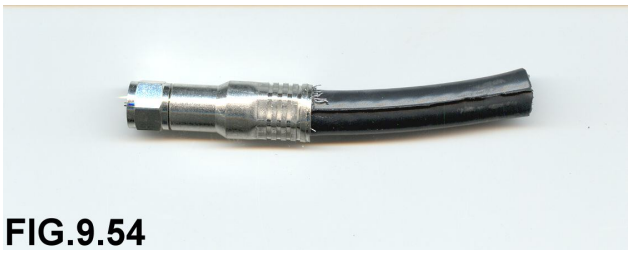


FIG.9.54

The F-connector will close around the coax to form a tight connection. See **figure 9.54**.

Now, when we put everything together, we can keep all the phone lines, TV cable lines, network lines, and even speaker wiring neatly organized so they all run a straight line back to the distribution box. Distribution boxes look confusing and intimidating at first, but everything has its proper place. See **figures 9.55** and **9.56**.

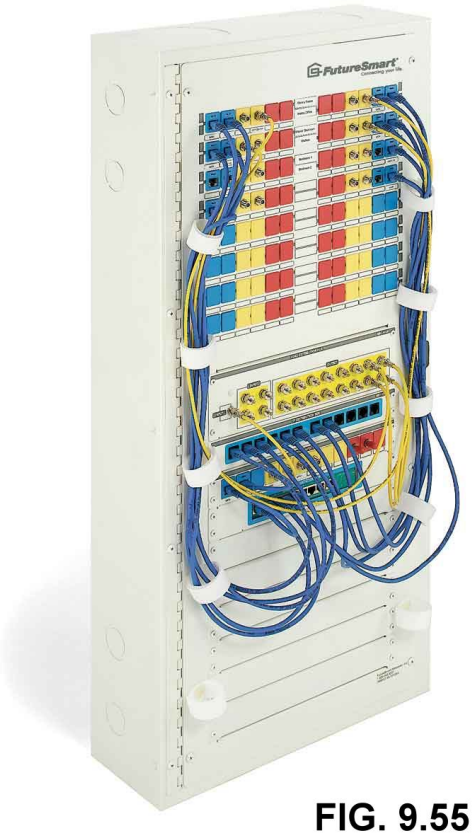


FIG. 9.55

FIG. 9.56

This wraps up the chapter on Electrical Circuitry. You might be a little hesitant to do the electrical work yourself, but you can save so much by doing the work. Electricians really do charge a lot for labor and that's money out of your pocket that just doesn't need to be spent that way. Besides, it's a huge advantage to have knowledge about home wiring. This chapter is brief yet thorough enough to get the job done.

Exterior Siding

This is my most favorite part of the whole construction process. It's easy and fun and your house project will emerge a beautiful creation in just a few days. Exterior sidings are important not only for looks, but also for protection from the elements over the years. A house can stay preserved in a new condition for decades or a house can dilapidate and fall apart in just a few short years depending on the exterior barriers. My whole purpose for creating this book is to teach people how to build a nice home on low income. As I've covered many times, this is a way for people to get a new home and to financially propel themselves years ahead of others who decide to hire someone else to do it for them. With drastically reduced monthly payments, we can afford to do things we otherwise couldn't even dream of doing. It's all because of sweat equity. It's a wonderful thing.

I bring this point up occasionally to remind us all that we have to make certain decisions during the building process. Decisions not to overspend on unnecessary materials. Because as I've said before, if we buy the finest quality without regard to cost, our building project will not get finished and we'll run out of money before we're done. I think most of us have seen major investments in real estate go bad. A hotel, a lodge, a condominium, or whatever, that was put together by people who had insufficient capital, yet ignored the warnings. Suddenly, the funds are spent, the project is over budget as usual, and nobody will step in to save the visionaries from financial ruin. The project remains unfinished and is either purchased by someone who can pay the bank and usually some mechanics liens, or the project is scrapped and something else goes up in its place.

Our main focus here is to produce a quality home at a very low cost. There are many areas where we can save a lot of money and choosing vinyl siding instead of brick or any other expensive siding material is the best choice by far. The only people that will really bad mouth vinyl siding are those who can afford brick or perhaps those who sell aluminum or some other siding that isn't a good economical choice for someone in our tax bracket.

Vinyl is a dream to work with. It's fairly durable, and very economical. It has a few obvious setbacks, but the pros far outweigh the cons. It is the only exterior siding I will cover in this section because to me the choice is a slam-dunk.

The positive qualities of vinyl siding are that it's maintenance free. It never needs to be painted and it holds its color very well. It can be cleaned with a garden hose. It helps insulate the house. Most brands of vinyl have a lifetime guarantee and so far from what I've seen, they could last years without maintenance.

The major expense with vinyl, as with most things, comes from the installation done by professionals. It doesn't take a professional to put up siding, just a person that knows a few characteristics of the product, and has a little common sense.

The most important fact to know about vinyl is that it expands and contracts with the temperature. Each strip is nailed in place, but the nails aren't driven in all the way. The strips of vinyl have nailing flanges, but are more or less hanging in place by the nails. Each strip should be able to move freely from side to side. A few years back, I remember seeing a few homes with this new product installed. The homes looked great, but just after a few weeks; the vinyl was doing some nasty tricks. It was pulling apart in places and leaving gaps and swells in other places. The homes were new and the siding installation was still under warranty so they were do-overs for sure. The problems were an easy fix once the installers understood that they were not supposed to hammer the nails in all the way. Many contractors and installers have learned this way. Anymore, this is common knowledge about vinyl siding, but the novice builder can sometimes make these same mistakes. So here's the heads up on that subject.

There are ten rules to follow for basic installation. These rules are made by the actual manufacturers of vinyl siding and can be found wherever you buy vinyl siding.

1. Installed panels must move freely from side to side.
2. When installing a siding panel, push up from the bottom until the lock is fully engaged with the piece below it. Without stretching the panel, reach up and nail it into place.
3. Fasten nails or other fasteners in the center of the nailing slot.
4. Do not force the panels up or down when fastening into position.
5. Do not drive the head of the nail tightly against the siding nail hem. Allow 1/32" (about the thickness of a dime) clearance between the fastener head and the siding panel. Drive nails straight and level to prevent distortion and buckling of the panel.
6. Leave a minimum of ¼" clearance at all openings and stops to allow for normal expansion and contraction. When installing in temperatures below 40 degrees, increase minimum clearance to 3/8".
7. Do not caulk the panels where they meet the receiver of inside corners, outside corners, or J-trim. Do not caulk the overlap joints.
8. Do not face-nail or staple through siding. Vinyl siding expands and contracts with outside temperature changes. Face-nailing can result in ripples in the siding.
9. In residing, furring or removal of uneven original siding may be necessary.
10. In new construction, avoid the use of green lumber as the underlayment. Keep in mind that siding can only be as straight and stable as what lies under it.

Some of these might seem a little redundant, but they are worth mentioning a few times. The siding will be able to cover all parts of the house that are visible except the roof. The eaves and soffit will have vinyl or metal coverings that will give them a professional look. **Figure 10.1** shows the parts of the exterior that will be covered.

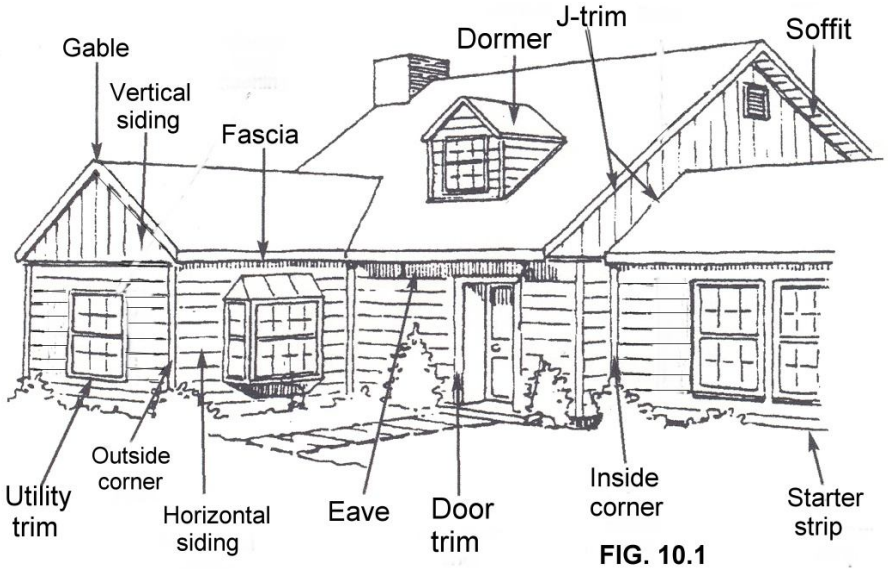


FIG. 10.1

Let's run down the list of the different parts and where they go. We'll start off with the vinyl panel itself, which can be several styles both in size and color. The panels are usually 2 rows of 4 inches or double 4's, but some are 4 ½ inches for a total coverage of 9 inches. See **figure 10.2**.

FIG. 10.2

FIG. 10.3

Figures 10.3 and **10.4** show how the panels fit together with a top lock and a bottom lock.

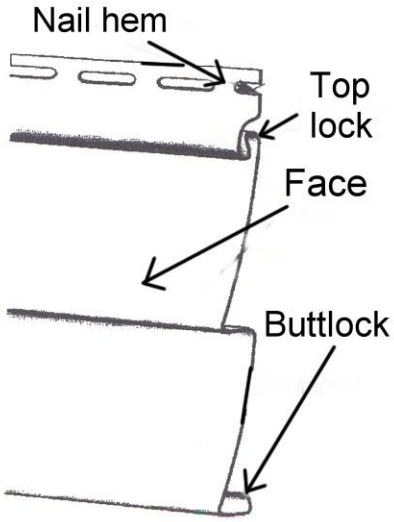


FIG. 10.4

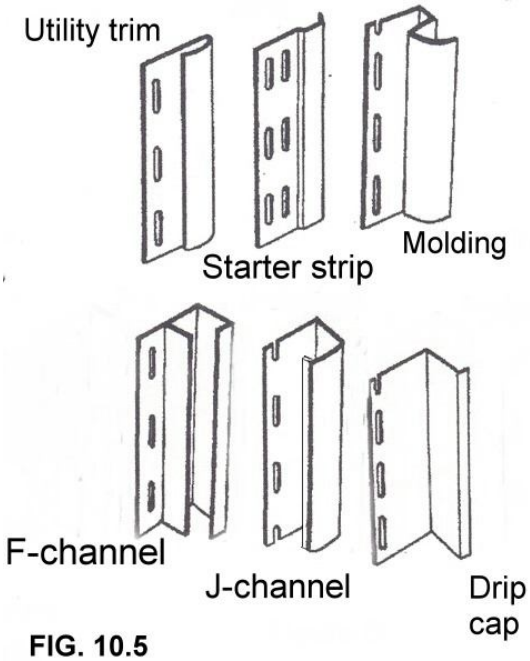


FIG. 10.5

Figure 10.5 shows the siding accessories. First is the utility trim, which goes below the eave and holds the top panel in place. Next is the starter strip, which is where you attach the first panel and then work your way up to tuck the top panel into the utility trim. The F-channel holds the soffit panels in place and gives the eaves a professional look. J-channel is installed around windows and doors before the vinyl panels are put up. The vinyl slides into the J-channel so the cut edges of the vinyl aren't visible.

Let's get started on the installation methods. Most building materials centers will send someone to your building site to measure the house to get an estimate for materials needed. This is almost always free of charge. If by some chance you don't have a Home Depot, Lowe's or some other center, you may have to calculate the amount of materials yourself. There is an easy way to do this if you have to.

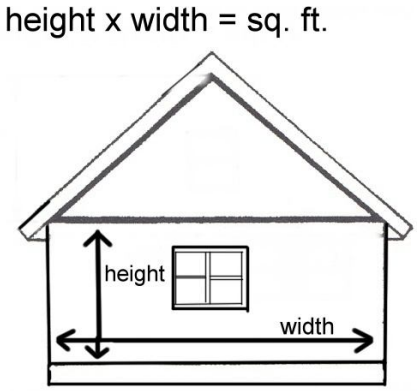


FIG. 10.6

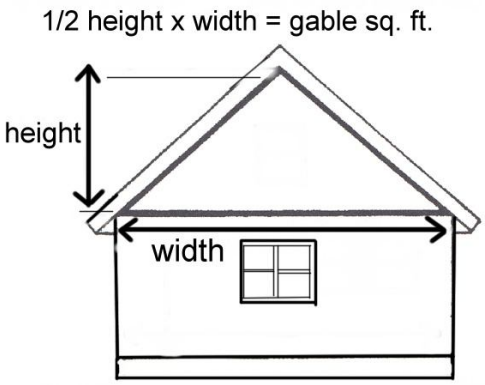


FIG. 10.7

For the wall area, you can just multiply the height times the width. See **figure 10.6**. Don't subtract anything for windows or doors. Also try to add an extra 10 percent to compensate for waste. You can get very close to the amount needed for the gable ends if you multiply half the height times the width of the gable as in **figure 10.7**. You can get the measurements for the starter strip, the utility trim, the J-channel and the F-channel simply by doing a linear measurement. The starter strip and utility trim are installed as in **figure 10.8**. The gable ends will have J-channel to hold the vinyl in place at the ends. See **figure 10.9**.

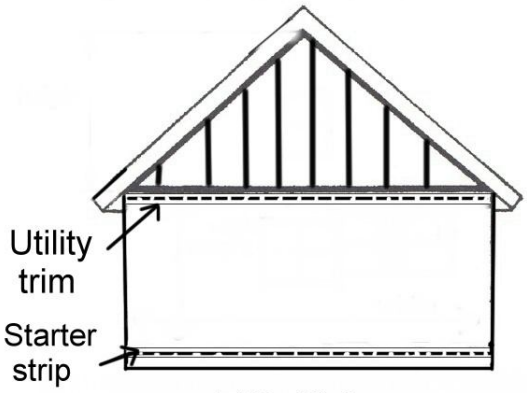


FIG. 10.8

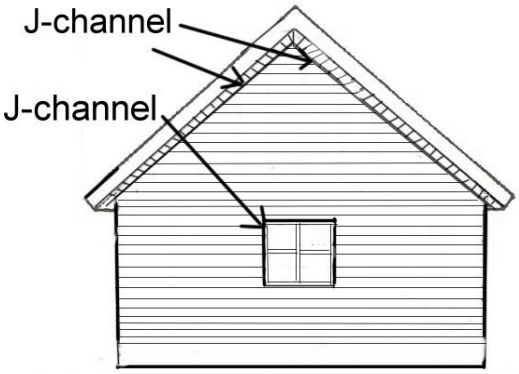


FIG. 10.9

You will use J-channel on gable ends, but also around windows and doors. The vinyl panels will tuck neatly inside the J-channel. A lot of J-channel will be used because of all the windows and doors in a home, but it's very inexpensive and it's extremely easy to work with.

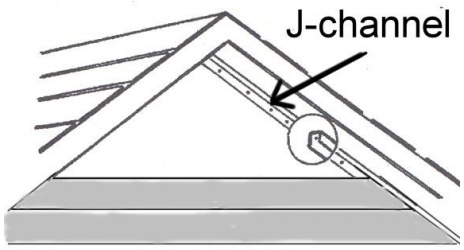


FIG. 10.10

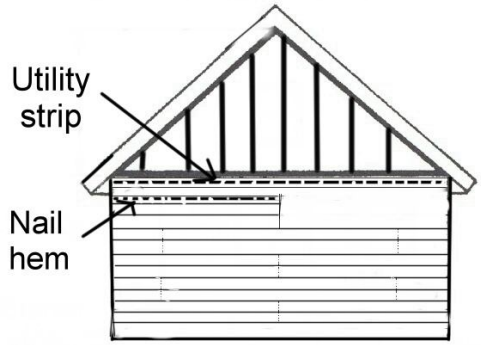


FIG. 10.11

Figure 10.10 shows how the vinyl tucks up into the J-channel on the gable ends. The utility strip will hold the top row of vinyl in place as shown in **Figure 10.11**. The nail hem has to be cut off from the top piece of vinyl. See **figure 10.12**. After the nail hem is removed, the vinyl needs to have snap-lock lugs punched into it about every 4 inches with a snap-lock punch. See **figure 10.13**. The top piece of vinyl then slides into the utility strip and snaps into a locked position which can move from side to side, but not down.

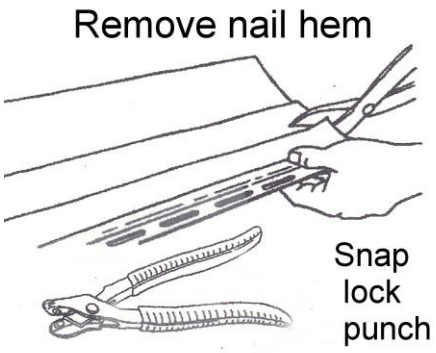


FIG. 10.12

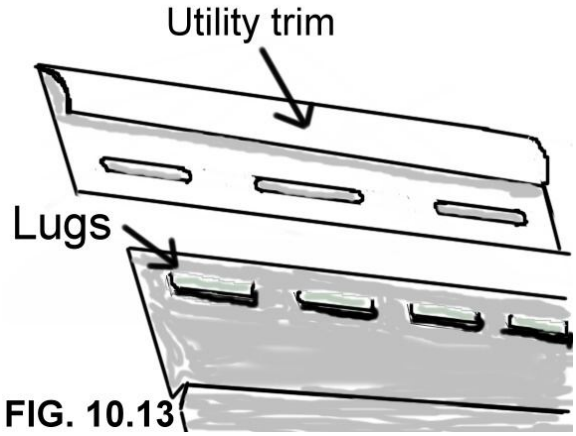


FIG. 10.13

Before the vinyl panels can be put on, all trim accessories have to be put in place. That includes flashing, soffit and fascia, J-channel, F-channel, utility trim, starter strip, inside corner posts and outside corner posts.

The best place to start is up on the eaves because the soffit should be finished before the wall panels go on, that way you get a nice even fit between the J-channel that holds the soffit panels and the utility trim that holds the top vinyl panel. Let's begin with the soffit and fascia installation.

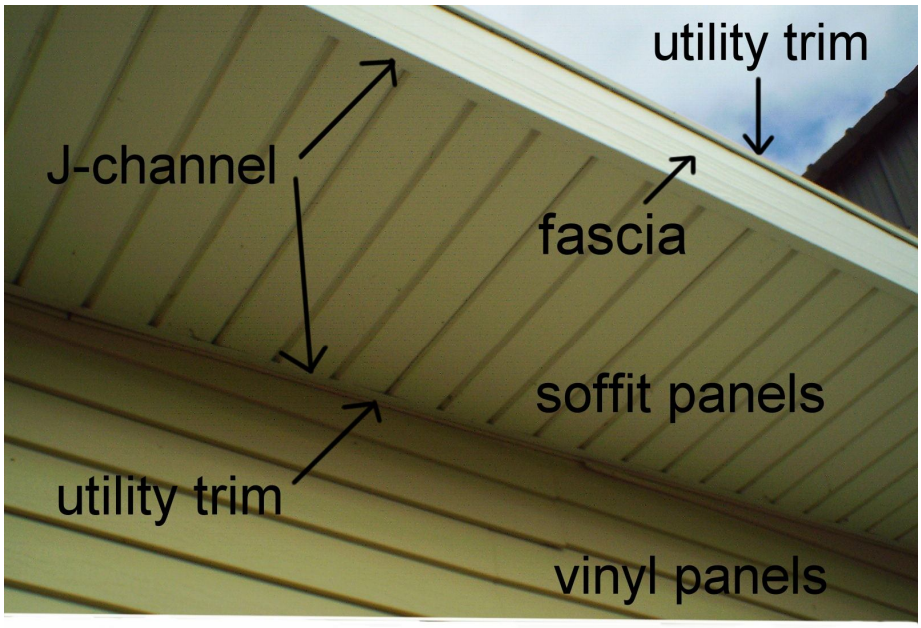


FIG. 10.14

In **figure 10.14** we can see the how the different accessories fit together to make a neat appearance. It all fits together tight and creates a good protection barrier from the weather.

The first thing to do when siding the eaves and soffit is to put up the J-channel or the F-channel on each side of the eave so that the soffit panels just slide in. See **figure 10.15**.

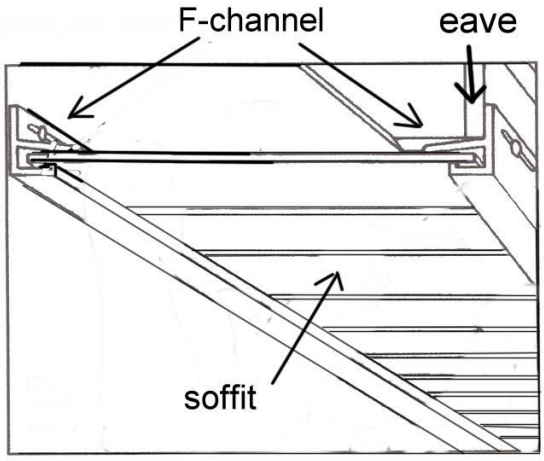


FIG.10.15

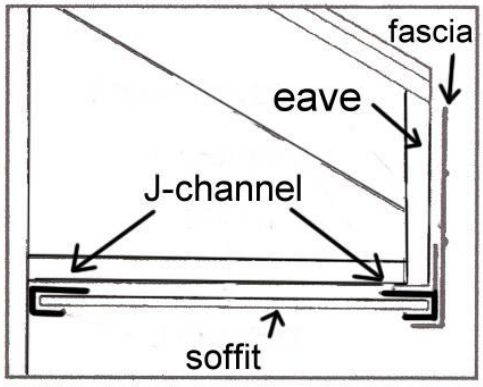


FIG. 10.16

You can see the difference between an open eave as in **figure 10.15**, and an enclosed eave as in **figure 10. 16.** The open eave needs the F-channel and the enclosed eave will need to have the J-channel attached.

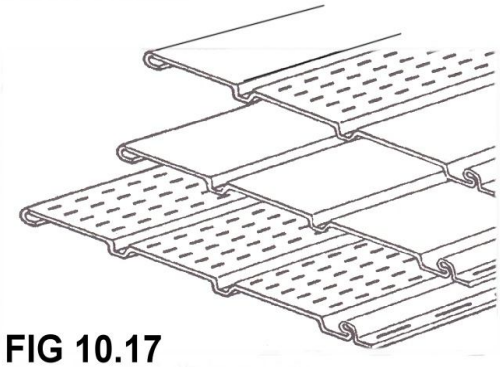


FIG 10.17

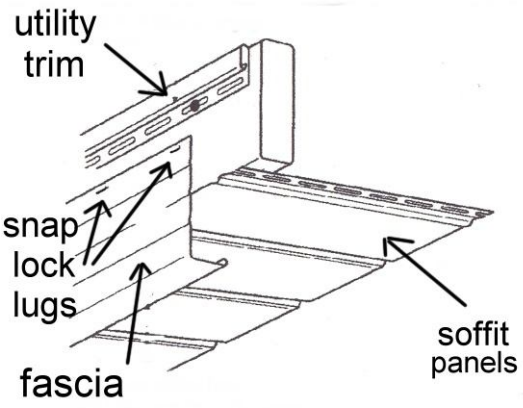


FIG. 10.18

The soffit panels come in different lengths and styles. See **figure 10.17**. They also come in vented or unvented varieties depending on the amount of vents you put in your eaves to create air flow and prevent rot. You can just cut them to fit up into the J-channel or F-channel. You're probably better off with metal soffit than with vinyl because it is stronger. It's very common to use metal soffit with vinyl siding. The fascia is usually made of metal as well and it just fits into place with the bottom fitting over the J-channel and the top will fit up into the utility trim. This means that the top of the fascia needs to have snap-lock lugs punched into it. See **figure 10.18**. These snap-lock lugs should be spaced about 6 inches apart and they should only be about 1/8 inch below the top of the fascia so that they make a good connection with the utility trim.

Now we can move on to the flashing. Flashing is what keeps moisture from entering vulnerable parts of the roof and walls. The flashing is just strips of metal that can be cut to fit anywhere. It needs to be put up before any J-channel goes on.

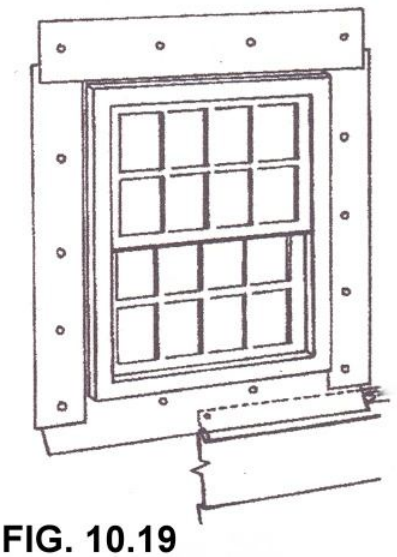


FIG. 10.19

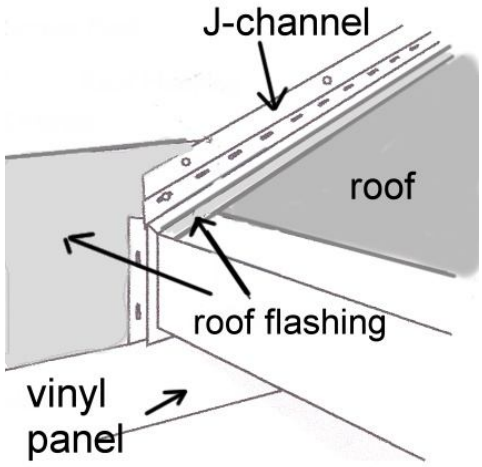


FIG.10.20

It's always a good idea to flash around windows, doors, corners, and any structure attachments. The idea of the flashing is to help the moisture get from the house to the ground with no resistance. As we can see in **figure 10.19**, you need to start at the bottom of the window with the first piece, and then do the sides overlapping the bottom. Finally, you'll do the top piece and it will overlap the two side pieces. This will keep any moisture that gets in from penetrating the sheathing and causing damage. Attached garages will need flashing where it connects to the house as in **figure 10.20**.

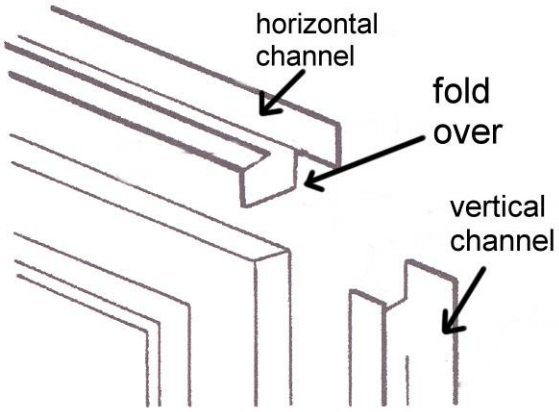


FIG. 10.21

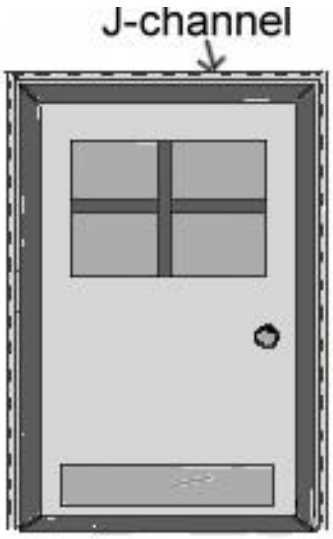


FIG. 10.22

After the flashing, comes the installation for the J-channel around windows and doors. The top piece of J-channel needs to overlap the side pieces as shown in **figure 10.21**. This helps keep water from getting in. **Figure 10.22** shows a door lined with J-channel. The windows are the same.

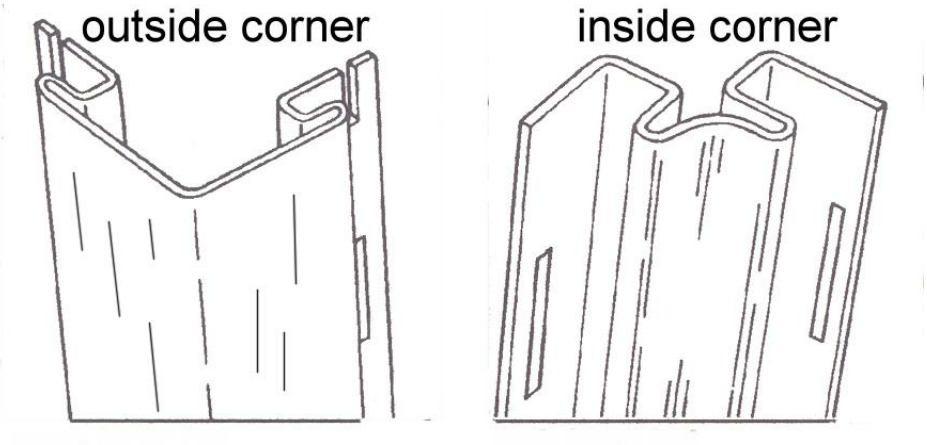


FIG. 10.23

After all the J-channel is put in place, then we can move on to the corner posts and special fittings for exterior outlets. There are outside and inside corner posts as shown in **figure 10.23**. The corners should have flashing covering about 10 inches on each side of the corner before the corner posts are put on. **Figure 10.24** shows an outside corner and how it is started. The top nail will be completely to the top of the nail hem hole so that the corner post rests there. All the other nails will be in the center of the nailing slot.

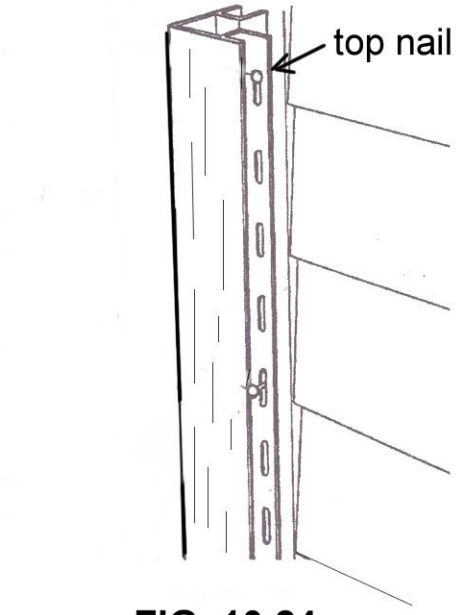


FIG. 10.24

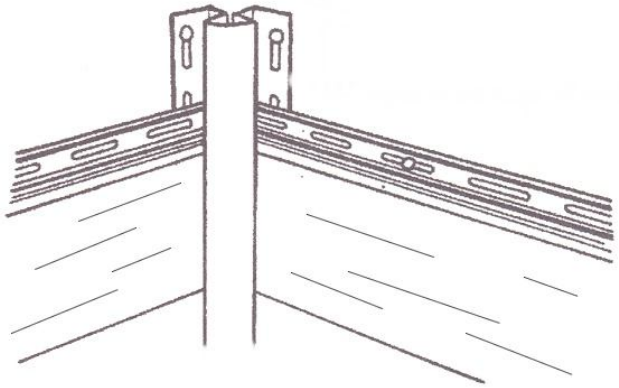


FIG. 10.25

When putting the corner posts on, you need to leave a ¼ inch gap between the top of the corner post and the eave or soffit. The corner posts will also extend down below the starter strip by about ¾ inch. That will make a neat appearance once the vinyl is in place. After the corner posts are done, you can put the external outlet fixtures on. These are prefabricated vinyl fittings for outlets, lights, spigots, dryer vents, etc. See **figure 10.26**.

FIG. 10. 26

These fittings make the job a lot easier and they are quite inexpensive. They give the exterior a nice finished look.

Now that all the vinyl accessories are done, we can start the vinyl siding. To make sure that the vinyl panels are even all the way around the house, we need to take some measurements on one wall from corner to corner. Start at the soffit and measure down to the top of the foundation. Subtract the width of the starter strip plus ¼ inch. See **figure 10.27**. Mark that spot or put a nail there and attach a chalk line. Next, you will go to the other corner and do the same measurement. Stretch a chalk line between the two measurements and use a 4 foot level to make sure it's level. You will be able to find the lowest corner of the house by this means. The lowest corner is where you begin your reference point. Snap the chalk line and then move on to the other sides of the house. See **figure 10.28**. When you get back to the starting point, the chalk line should match up. You can start the first piece of starter strip by putting it against the chalk line so that the top touches the line.

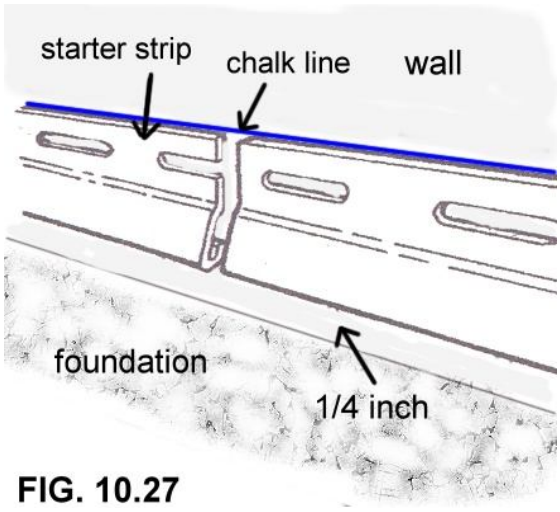


FIG. 10.27

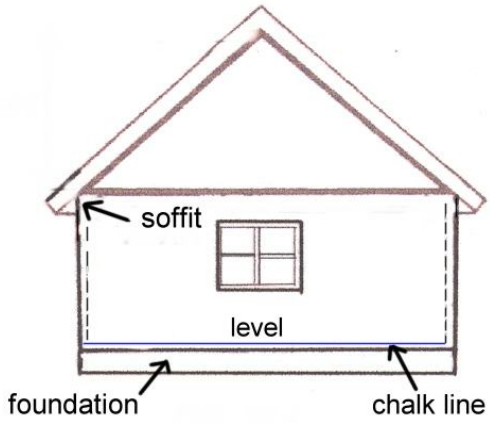


FIG. 10.28

Be sure to leave about ¼ inch gap between starter strips to allow for expansion. Now we can put our first vinyl panel in place. See **figure 10.29**.

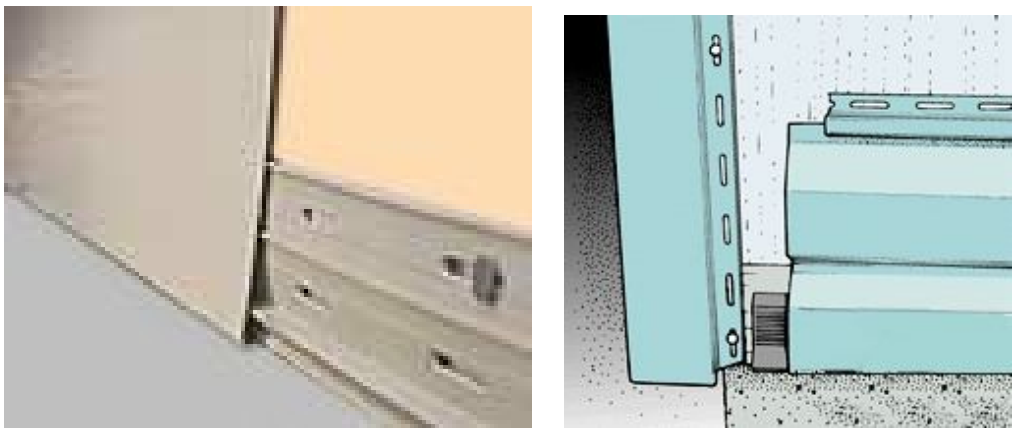


FIG. 10.29

The first panel will lock in place over the starter strip and will slide into the corner post as shown in **figure 10.29**. You will want to leave ¼ inch gap when you slide the panel into the corner post so it doesn't go all the way in to the end. That will leave room for expansion. Then pull the panel up so it has a snug fit and nail it into place using the centers of the nailing hems. Don't pull up too hard on each panel. You don't want to stretch the panels because they will pull away with temperature changes. Try to straddle or offset the seams so they look nice. See **figure 10.30**.

FIG. 10.30

The panels will overlap about 1 inch where there is a seam, that will prevent them from pulling apart and leaving the walls exposed. See **figure 10.31**.

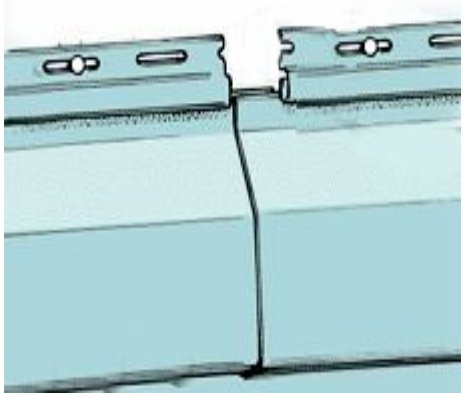


FIG. 10.31

Once you get to the last row, you will need to make a special fit by measuring how wide the last piece has to be. Then you will cut off the nail hem and punch snap-lock lugs into the panel so it will fit up into the utility trim. See **figures 10.31** and **10.32**.

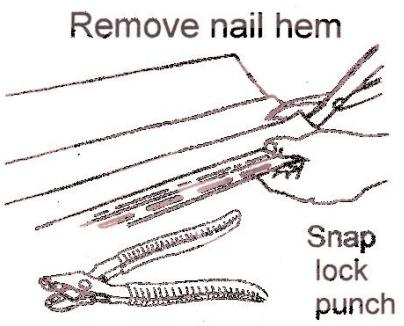


FIG. 10.31

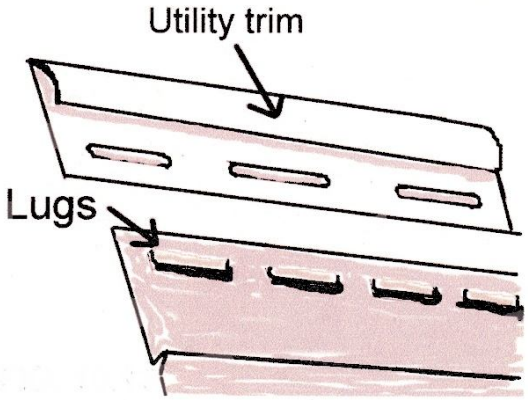


FIG. 10.32

The last piece just snaps in place and stays there. That is the last step to the vinyl siding project. Your work will look professional and you'll save at least half by doing it all yourself.

Vinyl siding is the best choice to accomplish what we need in terms of affordability and quality. There are many contractors that discourage the public from doing the work themselves. They say that an inexperienced installer can make costly mistakes. I don't go for that. I never did. Homeowners are going to take the time to get it right without rushing through it. Besides, vinyl is so easy to work with that even the most novice builder can learn the basics in just a short time and the basics is good enough to do a great job.

ELEVEN

The Roof

The roof is the first line of defense against the elements so it needs to be done right and with the right materials. The basic idea is that a roof will let water or snow run down to the ground with no stops on the way. If water forms pools on the roof, it has a more likely chance of getting in than water that runs straight off.

The type of roofing material depends mostly on the local climate. I will cover only two types of roofing materials because of our purpose in creating a nice home on a tight budget, there are many other choices that don't make sense. I live in an area where there is a fair amount of snow and ice, but rainfall is minimal. In these conditions, a person could use either asphalt shingles as in **figure 11.1** or metal panels as shown in **figure 11.2**

FIG. 11.1

FIG. 11.2

. Asphalt shingles are much less expensive than metal and they are of much better quality than they used to be. If I travel 30 miles north, most roofs are made of metal because of the heavy snowfall. Just 15 miles south of my home, most roofs are made with asphalt shingles and metal roofs are considered overkill.

I opted for a metal roof because of some of the problems I have seen locally with asphalt shingles. If you can get away with using shingles then do it because it's a lot cheaper. Metal is a little harder to work with because it's difficult to cut. The roof goes on faster with metal because so much area is being covered at one time. The cost difference is substantial though. The house will appraise for more with metal because it is more durable.

Now to start with, we will need to have a protective barrier to put directly over the sheathing or the wood on the roof. This moisture-resistant barrier is called roofing felt or tar paper. See **figure 11.3**. It's important that the roof is dry before this goes on or it will hold the moisture in and cause the roof to start rotting. See **figure 11.4**.

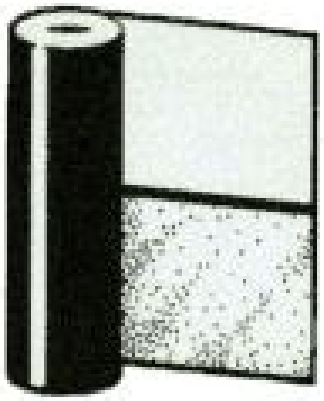


FIG. 11.3

FIG. 11.4

Roofing felt comes in different lengths, widths, and thicknesses. 15-pound felt is the most common thickness. You just roll it out starting at the bottom of the roof from one end to the other end. If you have to put two pieces together while going across, then you should overlap them at least 4 inches. You can secure it with galvanized nails, but only put in as much as is needed to prevent the wind from blowing it away. The second row will need to overlap the first row by at least 2 inches. That's why you start at the bottom and work your way up. See **figure 11.5**.

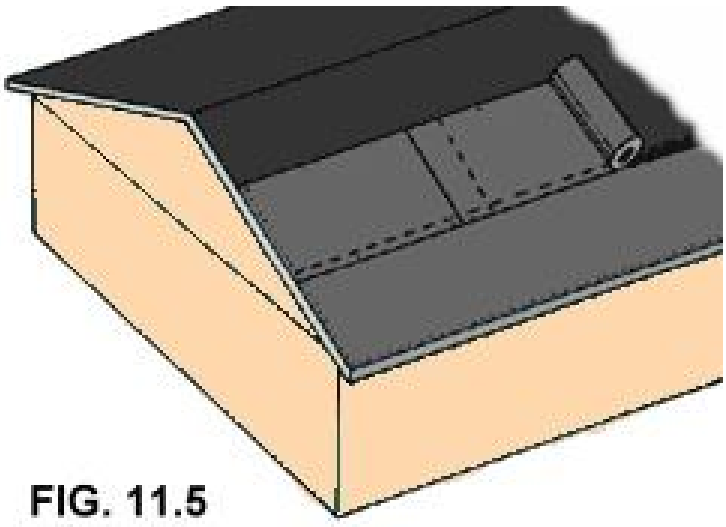


FIG. 11.5

Once you have finished with all the roofing felt you will need to consider the areas that need flashing. The flashing material is important and can be found wherever roofing materials can be found.

Figure 11.6 gives us a good idea how the flashing is applied and shows its purpose in diverting moisture downward in vulnerable areas such as valleys, hips, chimneys, vents, or any other attachments.

FIG. 11.6

This shows how the flashing is installed and where it is placed above the shingles or beneath them.

The flashing for metal roofs is applied in exactly the same manner as shingles. The only important difference when doing a metal roof is that the flashing and the fasteners be the same type of metal as the roofing material to prevent electrolytic action which causes deterioration. You can usually find the same color of flashing as the metal you buy at the same place.

Now let's move on to the actual installation of shingles and metal for roofing. Shingles come in many different sizes, thicknesses, styles and colors. Local codes will determine the required weight of the shingles. Asphalt shingles are categorized by weight where the heavier the shingle, usually the better quality it is and the more expensive. The weight is calculated by how much a hundred square feet of coverage will weigh.

It also has different class ratings which is important where local fire codes matter. For instance, Class A shingles are made of noncombustible glass fibers which make them fire-resistant. Class C, for example, only has a moderate resistance to fire because they are made of organic-based materials. All-in-all, the most popular style is the 3-tab square butt shingles. They are really easy to work with also. See **figure 11.7**.

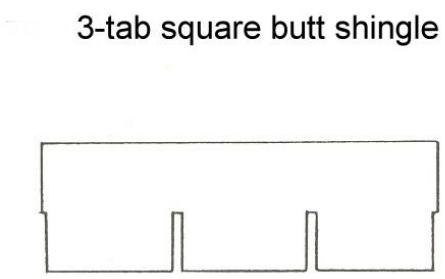


FIG. 11.7

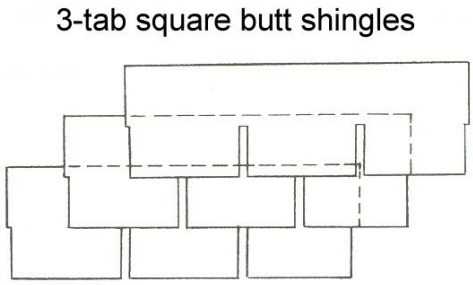


FIG. 11.8

The most important thing to remember about shingles is that they need to be offset so that the tabs don't line up. So we need to have a starting point to begin. We already know that we want to start at the bottom of the roof and work our way up, but some contractors like to start at one end of the roof while others like to make a centerline and start from there. Measure the halfway point and snap a chalk line for a reference point. See **figure 11.9**.

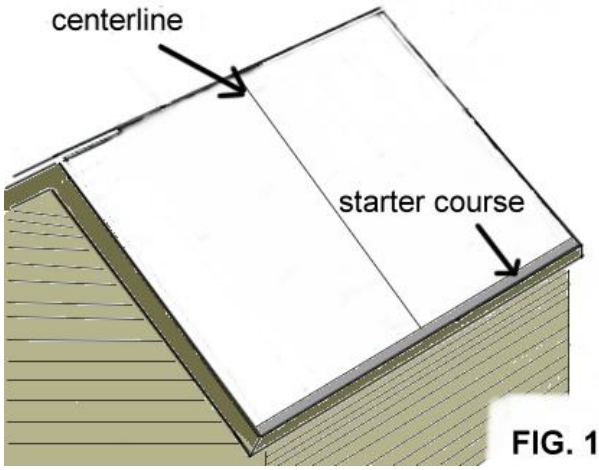


FIG. 11.9

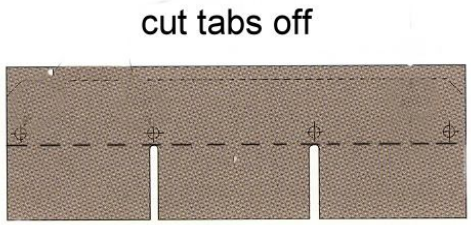


FIG. 11.10

The first row is called the starter course and it's basically a buildup or reinforcement so the edge will have more strength. You can buy starter course shingles if you want, but it's just as easy to cut off the tabs so you have a straight shingle to start out. See **figure 11.10**. Now we'll start out the actual shingle coverage by putting the first shingle in the center of the centerline and make sure to set the shingle at least 1 inch beyond the sheathing so that water and snow will fall away from the eave. See **figure 11.11**.

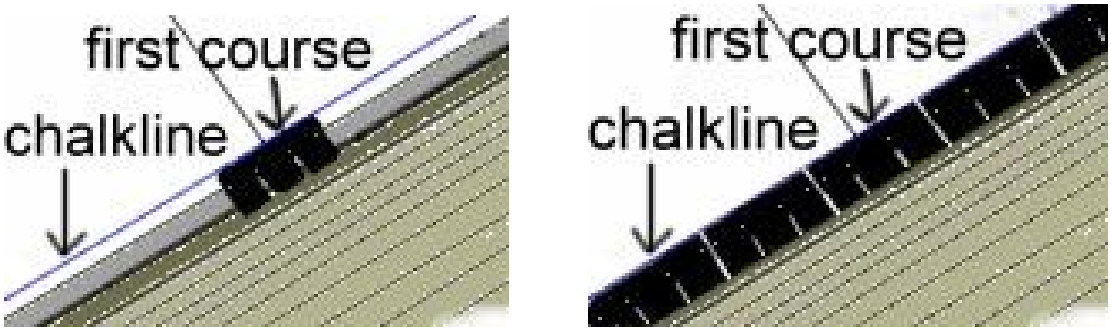


FIG. 11.11

The first row of shingles should be laid out completely before you nail them in place so you can make sure they are even. It helps to snap a chalk line above the starter course to keep things in order. Once all the shingles are laid out and nailed down, we can start our second row. The second course shingles need to be offset from the first course so the tabs don't line up. See **figure 11.12**.

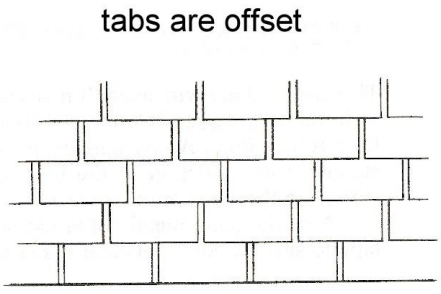


FIG. 11.12

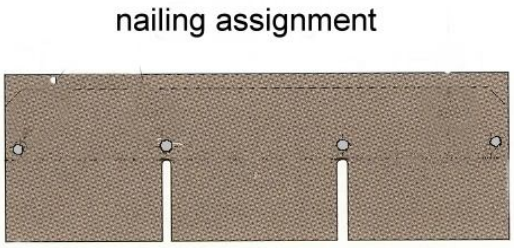


FIG. 11.13

Each 3-tab shingle will need four nails to make it secure. The nailing assignment is manufacturer specific so it should be followed closely. See **figure 11.13**.

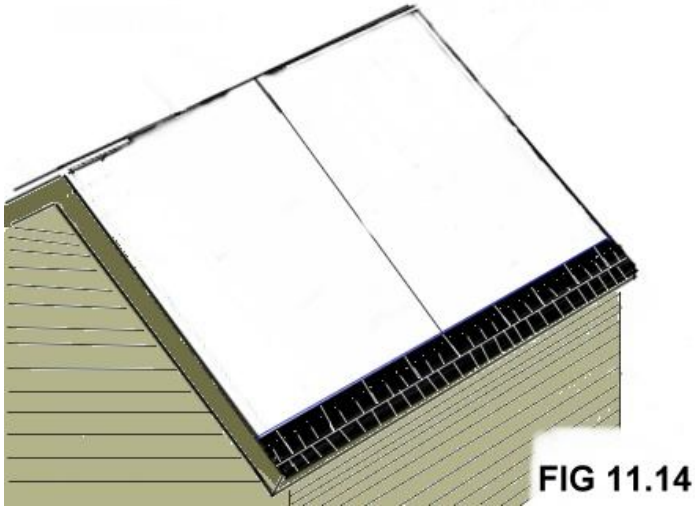


FIG 11.14

The second row offsets the first row and so on until it's finished. See **figure 11.14**.

You will want to put on all vent covers and lay the shingles accordingly. See **figure 11.15**.

FIG.11.15

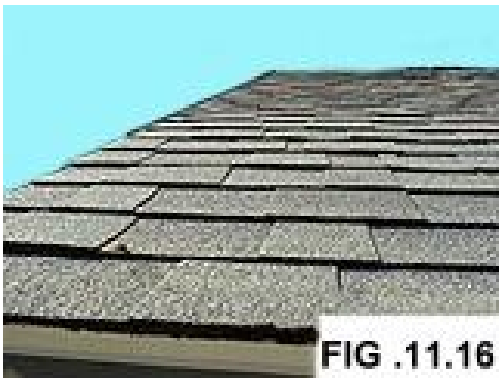


FIG .11.16

It's important to use the proper nails and to drive them in straight. See **figure 11.17**. Also, you don't want to drive them in too far because that can damage the shingle. The nailing position is important to prevent the shingle from buckling. You need to start from one side of the shingle and nail each slot across. See **figure 11.18**.

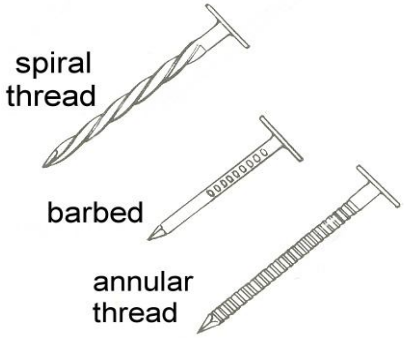


FIG. 11.17

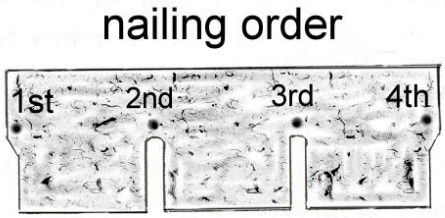


FIG. 11.18

You will need a special type of shingle for the ridge called the ridge cap or ridge roll. You can make your own by bending shingles, but they can sometimes leak. It's better to buy them because they are reinforced for that purpose. See figure **11.19**.

FIG. 11.19

FIG. 11.20

Now let's suppose we wanted a metal roof. Some manufacturers call it steel. A steel roof is quite easy to install, it's just kind of difficult to cut. I use tin snips, but you can also use an abrasive blade in a circular saw. That works quite well. The flashing is the same except that the flashing needs to be the same type of metal and it should be the same color. It comes in long sheets usually no longer than 12 foot lengths in residential, but you can special order longer sheets if you need them. See **figure 11.21**.

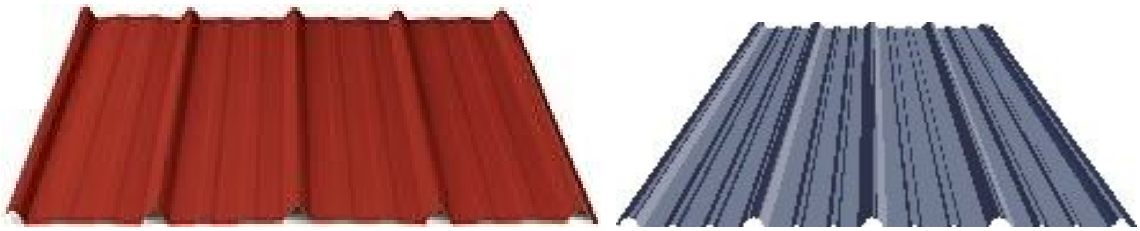


FIG. 11.21

The sheets can overlap to increase the length and they fit closely together with the corrugations. See **figure 11.22**. There is an over lap side and an under lap side. They fit tightly together and the overlap side needs to have screws put in it so the wind doesn't get under it once two sheets are fitted together. See **figure 11.23**.

FIG. 11.22

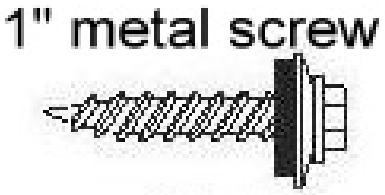


FIG. 11.23

The screws are usually hex head wood screws with a rubber ring. The screw shouldn't be over tightened. The screw is in far enough when the rubber just starts to expand out. **Figure 11.24** shows where the screws should be placed for maximum strength.

FIG. 11.24

When all the metal panels are installed we can now move on to the last step. The ridge cap or ridge roll is a specially designed metal panel that fits right over the ridge. See **figure 11.25**.

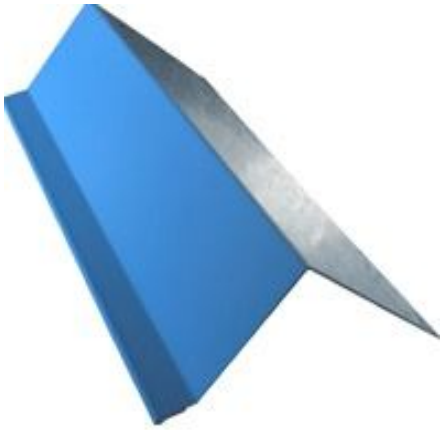


FIG. 11.25

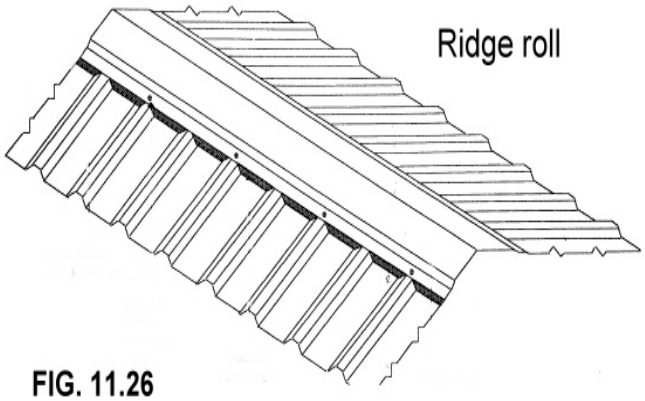


FIG. 11.26

The ridge cap needs to be secured by putting screws in the ridges. That will keep the ridge from bending or buckling in places. You can fill in the valleys under the ridge cap with roof cement to prevent wind and rain from getting in.

That's it for roofs. Just remember to be careful especially when working with metal because it is bulky and you can become a kite on windy days.

TWELVE

Heating, Venting, and Air Conditioning

There have been a lot of improvements over the years in the area of heating, venting, and air conditioning or more commonly referred to as HVAC. A century ago things were much easier. Most homes had a fireplace and a few windows and that was their HVAC. Things are quite a bit different today as we have many complex forms of HVAC's out there. They can seem difficult to understand, but they really aren't too difficult to install and maintain. Some of the modern day HVAC systems are very expensive and even though they will save on electricity costs because of high efficiency, it's better to start out with a more economical system. Remember, if you use the finest quality materials and fixtures all the time, you will probably run out of money before your house is finished. There might be a few contractors out there that would have plenty to say about that statement, but the truth is, they aren't going to install the highest quality fixtures either unless you ask for them. They make handsome profits from overcharging the wealthy and middle class for high quality fixtures, but most of the simple homes will get low end fixtures.

In this chapter I will concentrate on simple and inexpensive HVAC systems. Let's start out with the heating units. The easiest heating system to install is definitely wall heaters. See **figure12.1**.

FIG. 12.1

No duct work is needed because each room has its own heater. These are inexpensive to buy and fairly economical. They are much more efficient than they used to be. They are electric and come in several sizes, colors, and BTU's. The BTU is short for "British Thermal Units" (I think). It's just a means of measuring a heating area. The BTU's will go up as the wattage goes up, so for a big room, you may want to install a 3,000-watt heater, but for bedrooms, a 2,000-watt heater should be fine. They are also available in 120-volts, or 240-volts. The 240-volt series is more efficient in terms of power consumption. These heaters fit into a 4-inch wall easily enough. The rough opening for the hole in the wall will need to be framed in. See **figure 12.2**. Some heaters can be attached to a wall stud without being framed in. The dimensions for the canister are on the box. The canister fits into the wall and houses the wiring. The heater fits into the canister, and then the grill is put on. See **figure 12.3**.

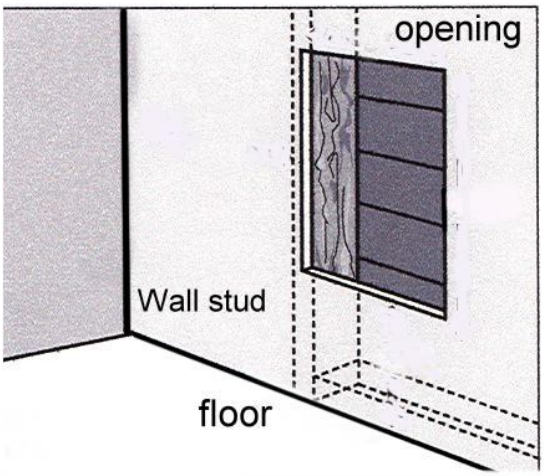


FIG. 12. 2


FIG. 12. 3

The wiring for these heaters is easy as well. For the 240-volt heaters, you will want to use a 30-amp breaker at the breaker box, and 10-2 Romex with both black and white wires as hot. See **figure 12.4**. These heaters should be placed on interior walls for the best efficiency so they aren't trying to heat cold air of an outside wall.

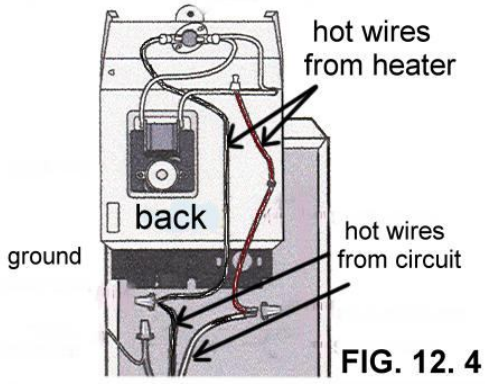


FIG. 12. 4

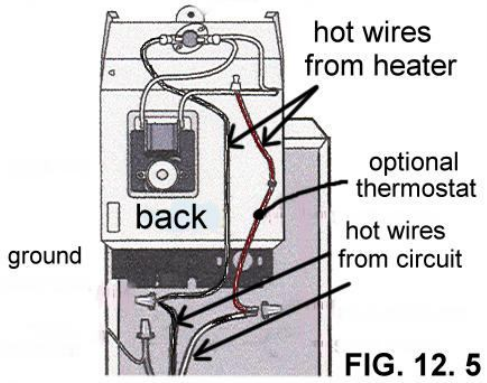


FIG. 12. 5

You can use 12-2 Romex, but 10-2 wire will tolerate higher wattages without getting hot. That way if you want to put in a larger heater in the future, the wiring will support it. **Figure 12.5** shows how the wires from the heater are connected to the heating circuit. All these wiring standards will be subject to local codes. The electrical inspector will have the minimum standards necessary for this type of heater. You should probably put no more than three heaters on one circuit to avoid overload. This circuit will of course be a dedicated circuit to heating units only. **Figure 12.6** shows different types of heaters.

FIG. 12.6

The next type of heat system is a stove or fireplace. Gas stoves are much more efficient then ever before. Woodstoves are a good investment if you don't mind gathering and chopping firewood. Fireplaces now have inserts that make them more efficient, but an open fireplace is more for atmosphere and ambience than heating. Stoves that use natural gas and propane are inexpensive to buy and fairly economical. See **figure 12.7**. We can see how to vent a gas stove in **figure 12.8**. You can also put the vent straight up in single story homes. These stoves are more efficient with fans or blowers installed.

FIG 12.7

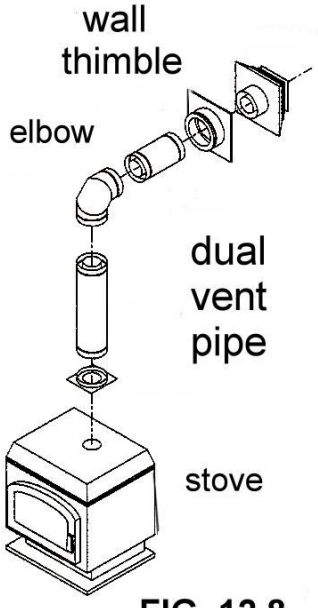


FIG. 12.8

The next form of heater we will look at is a furnace type with duct work. This is usually a furnace that can be gas, electric, or oil. See **Figure 12.9.**

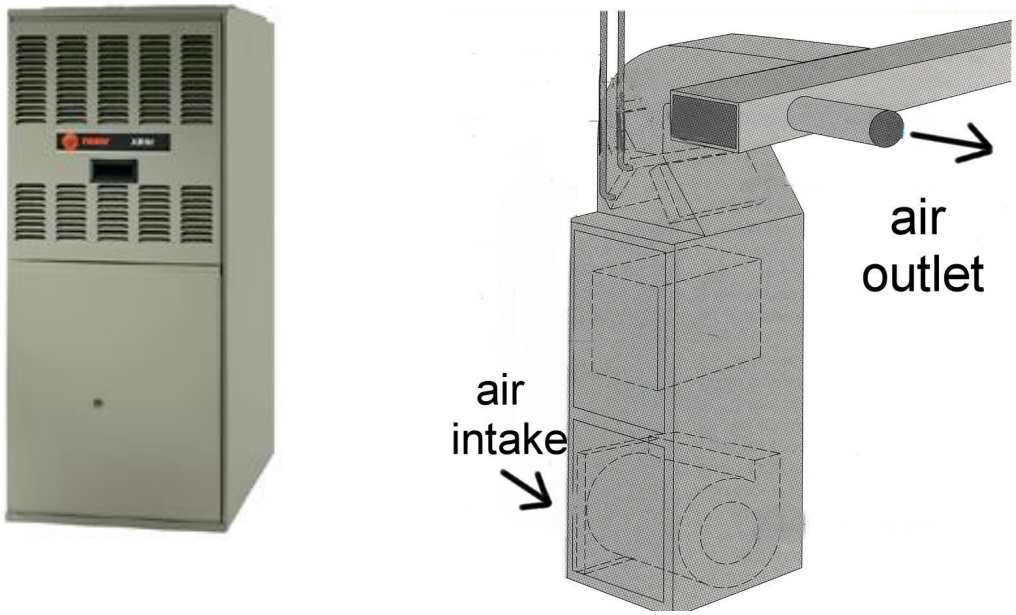


FIG.12.9

It has heat ducts going to each room in the house and usually has an air exchange system to bring air back to the furnace. See **figure 12.10**

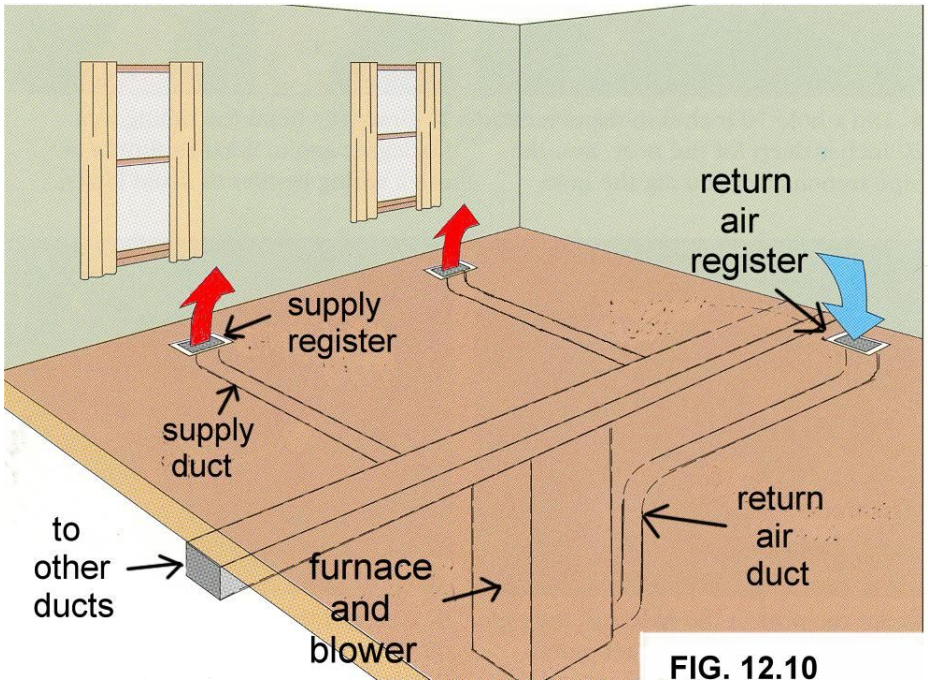


FIG. 12.10

Metal ductwork was pretty much the main type of venting material used for a long time, but now it's quite common to see flexible ducts. Flex ducts are much less expensive than metal and a lot easier and faster to install. See **figure 12.11**. They can be installed right into the floor joists, rafters, and crawlspaces. The trick is to get a good tight fit so that air doesn't escape.

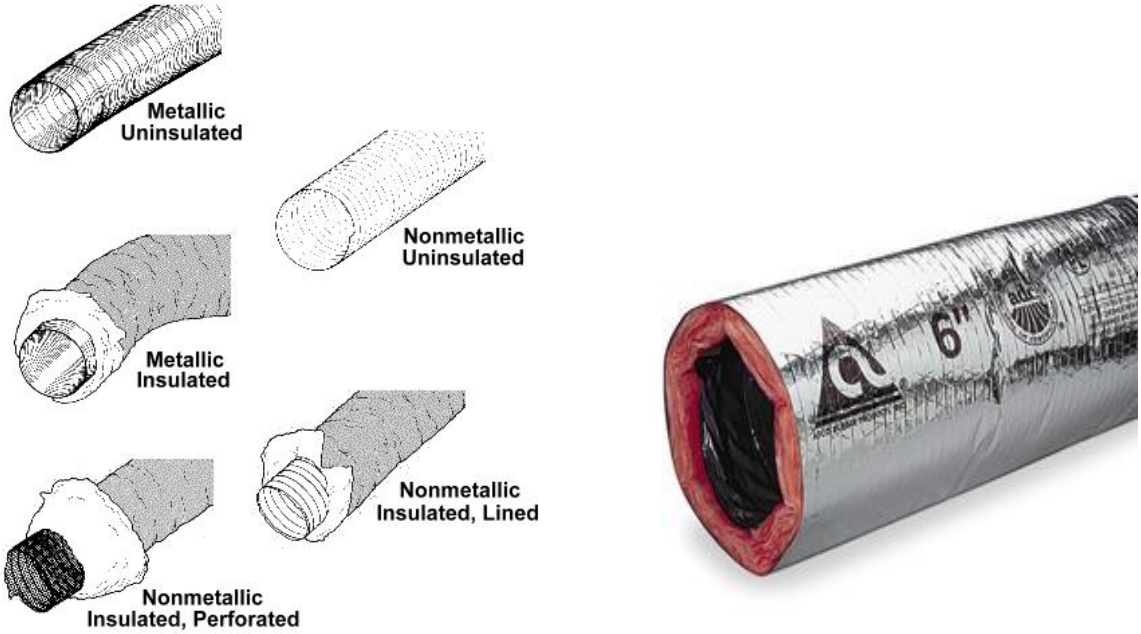


FIG.12.11

The air-conditioning system can be included in the heating ductwork. It is usually run this way to save materials. **Figure 12.12** shows some examples of air conditioners. Air conditioners can be central or local. A big AC system using air ducts would be a central system. Smaller units in each room would be local air-conditioners. The decision of which to use depends on the local climate.

FIG. 12.12

THIRTEEN

Installing Insulation

One of my least favorite parts of the whole building process is installing the insulation. Modern day insulation and insulation methods are much better than they were three or four decades ago. Fiberglass insulation was a nasty, itchy product. Today, it's not bad. There are several methods of insulating your house, but we will stick with the most economical and the easiest. There are a few considerations to make before you get started. First of all, you should consider the local climate. Insulation comes in many forms, but the least expensive is the fiberglass rolls, so I'll only cover that kind. See **figure 13.1**.

FIG. 13.1

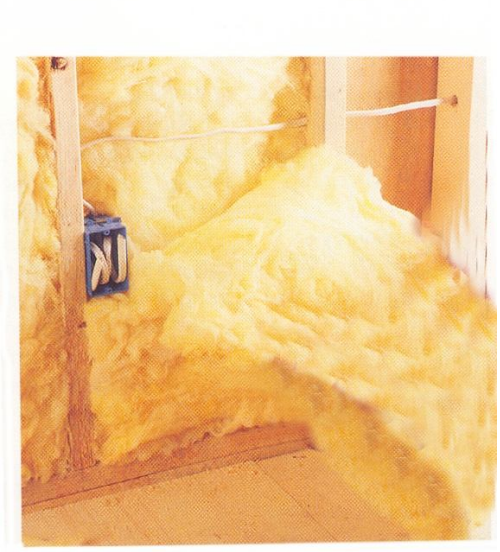


FIG. 13.2

Batted insulation comes in different widths and lengths. The two standard widths for wall studs are 16" on center and 24" on center. Insulation is made to fit snuggly into the walls, so both widths are available almost anywhere. The money spent on insulation is always money well spent. Three decades ago, the standard wall thicknesses were the width of a 2x4 stud. We know better now, so most walls are made with 2x6's instead. This allows more insulation which is a good thing in both the summer and the winter.

Insulation is measured by its R-value. The higher the R-value, the better, and usually the thicker the insulation. Here are some examples of R-values and insulation thicknesses. The climate map is a general guideline. Local codes will be slightly more demanding. See **figure 13.3**.

Recommended R-values

	A	B	C	D
	30	0	11	11
	30	0	11	19
	38	19	11	19
	38	19	11	19
	38	19	11	19
	38	19	11	19
	49	19	11	19
	49	19	11	19
	49	19	11	19
	55	19	11	19

A=Ceilings below ventilated attics
B=Floors over unheated basements
C=Exterior walls (wood frame)
D=Crawl space walls

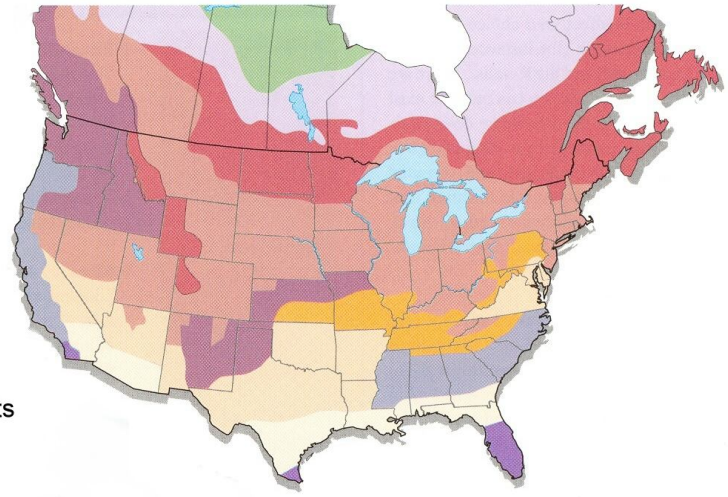


FIG. 13.3

Most codes have a minimum of R-11 for the walls, but if you have 2x6 walls, you will be better off with R-19. It will make a lot of difference in temperature extremes. You can see the R-values according to board thickness in the graph in **figure 13.4**. Some insulation bats have a small flap on the edge to staple so it stays in place. Other rolls might need to be held in place with plastic as in **figure 13.5**.

Board	Size	R-value
2x4	3 1/2"	R-11
2x6	5 1/2"	R-19
2x8	7 1/2 "	R-22
2x10	9 1/2"	R-30
2x12	11 1/2"	R-38

FIG. 13.4

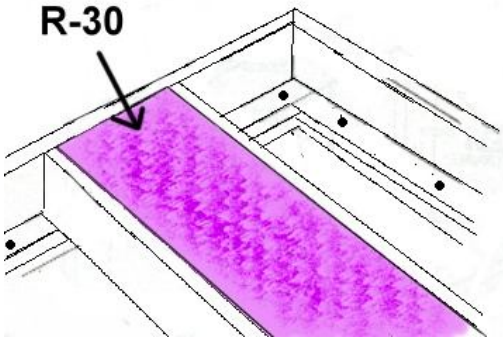
FIG. 13.5

The chart in **figure 13.4** gives a general idea of the thicknesses used for each size of board. **Figure 13.6** shows the outside walls that will be covered in either R-11 or R-19 depending on the thickness of the wall studs. The interior walls don't need insulation.

FIG. 13.6

. It's also really important to insulate the floors as shown in **figure 13.7**. Some might not feel it necessary to insulate the floors, but it makes a big difference in heating and cooling a home.

FIG. 13.7



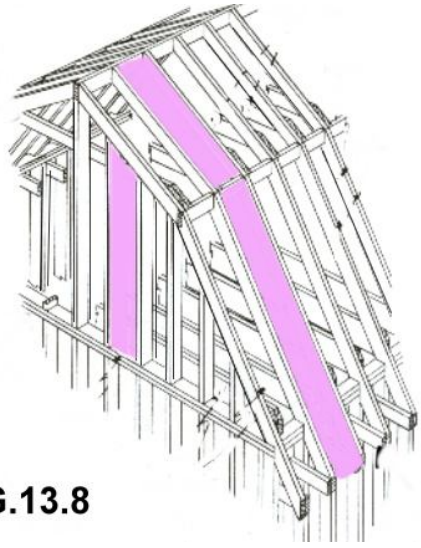


FIG.13.8

Insulating a Gambrel roof is different than a normal rafter roof because you will need to roll R-30 or R-38 into the rafters as shown in **figure 13.8**.

For a normal roof that uses regular trusses, the insulation is put into the rafters directly over the ceiling so there is a dead air space in the attic. This helps regulate heat and moisture under the roof. See **figure 13.9**.

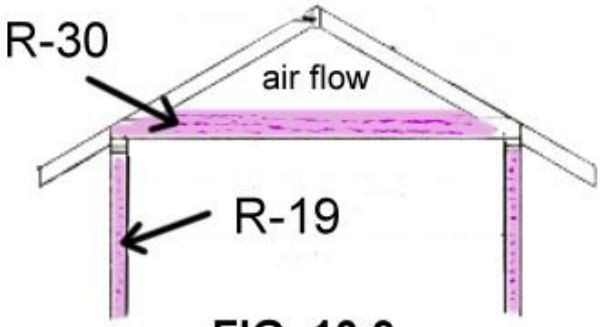


FIG. 13.9

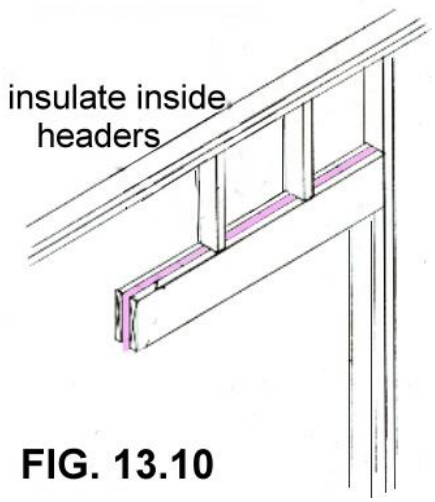


FIG. 13.10

There are a few areas that often get overlooked when insulating. One of those areas is inside headers and between rough openings for doors and windows. See **figure 13.10**. Also behind outlets, switches, and any place where there are openings in the sheetrock.

Installing the insulation is about as easy as anything can be, so I won't spend any more time on it. It just makes economic sense to be thorough and to do a good job, you'll be glad you did for many years afterward.

FOURTEEN

Walls and Ceilings

Now this is where the inside of the house really starts to take shape and you will get a whole new feeling about the building project. This is where our brain switches into finish-work mode from rough-in work mode. Everything from this point on will be done with the knowledge that it has to look good because it won't be covered up. By this time, first-time homebuilders are getting pretty good with measurements and cutting. Things are a little more precise than when you started. There is probably less waste and hopefully a few less smashed fingers.

This is where we put up the sheetrock. Sheetrock or Gypsum board, as it's sometimes called, is kind of heavy so this is a good place to get some help. The standard thickness in residential sheetrock is ½-inch. Before we start to put up any sheetrock, we'll need to make sure that the wall studs are straight and square. You can take a tape measure and check the inside walls to make sure the sheetrock will be on center to a wall stud. Remember, where two sheets are joined, there needs to be enough room on the stud to nail both sheets. **Figures 14.1** and **14.2** show how to measure the wall and apply the sheetrock.

FIG 14.1

FIG. 14.2

You will probably want to get some 1 or 2-inch boards, lathe, or furring strips to nail along side the wall studs where there isn't enough nailing room. These are called "nailers." Nailers help support the sheetrock in corners. Drywall hangers use nailers a lot because of the time they save. You can just nail, screw, or even apply them with adhesive.

The sheetrock needs to be secured to the wall studs or joists. Sheetrock comes in many different lengths, but is typically four feet wide. The most common size of sheetrock for walls is 4X8. Walls are either on 16" or 24" centers. Sometimes the walls are warped or out of square. That will throw off the measurements so the sheetrock won't line up on the studs to be nailed. Furring strips or nailers really help out in this situation. See **figures 14.3** and **14.4**.

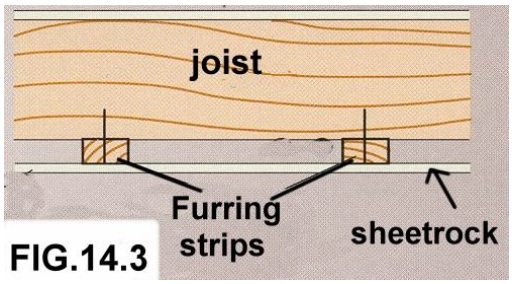


FIG.14.3

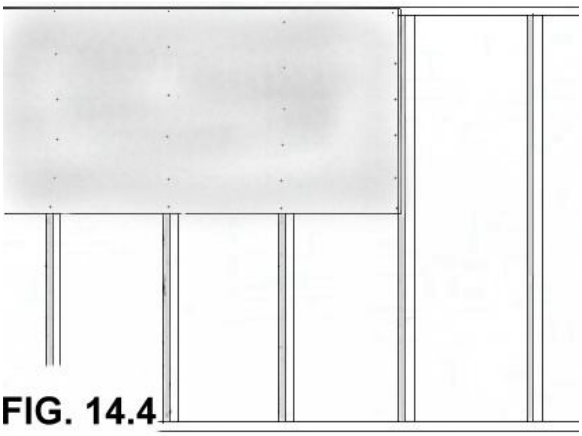


FIG. 14.4

Figure 14.5 shows a wall that is shimmed with a furring strip so there is adequate nailing room on the wall stud. **Figure 14.6** shows the different kinds of nails and screws.

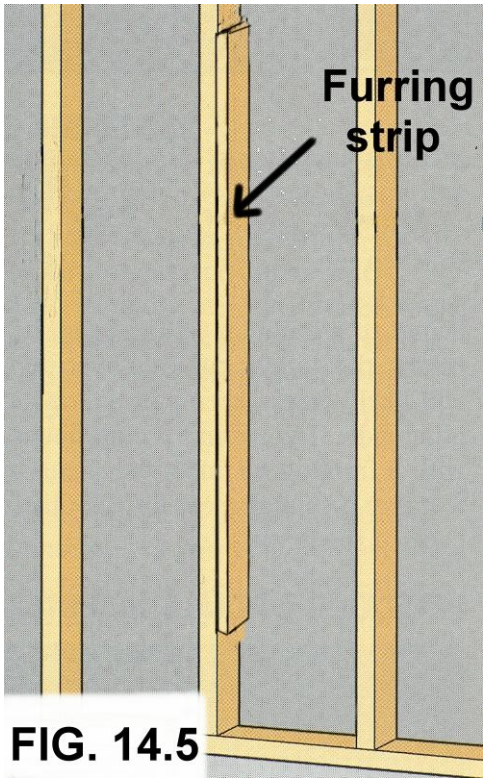


FIG. 14.5

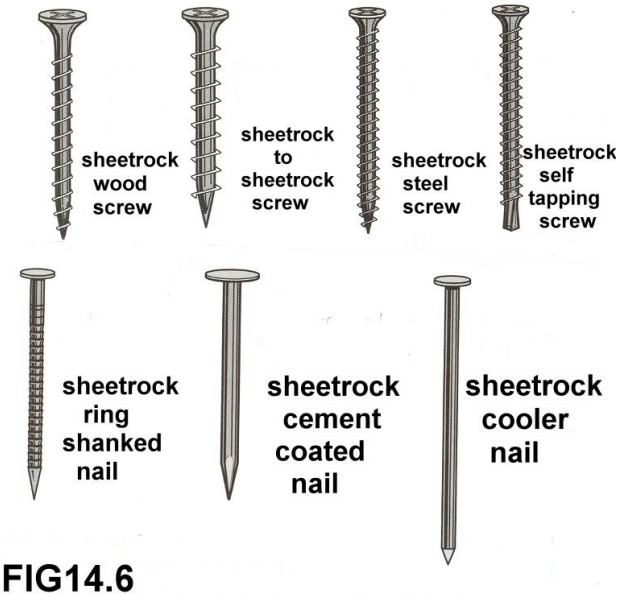


FIG14.6

These are screws and nails made solely for securing sheetrock. The nails need to be driven in just lower than the sheet's surface, but not deep enough to break the paper. It's easier to cover the nail heads that way. It requires a special hammer as shown in **figure 14.7**. If you choose to use sheetrock screws, make sure that you don't screw them in too deep.

FIG 14.7

. There is a special bit for sheetrock that prevents the screw from going in too far. See **figure 14.8**. Sheetrock can be cut with a utility knife as shown in **figure 14.9**.

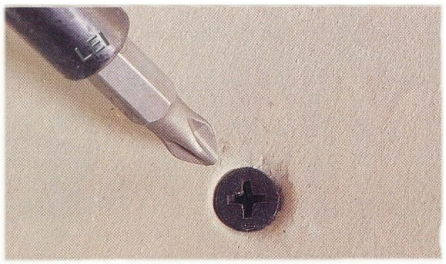


FIG 14.8

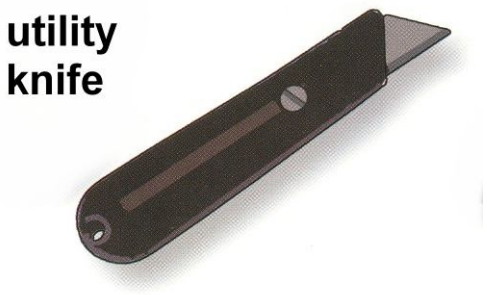


FIG 14.9

It only needs to be scribed enough to cut the paper and then it will break apart. You will need to cut out all the holes for outlets, switches, and light boxes. This gets a little tricky because there is no easy way of doing it. The best way is to measure how far up and over the box is and then write the measurements on the floor. A close fit is really important around the electrical boxes because the faceplates to the boxes will only cover up small gaps in the sheetrock, not really big ones. Sheetrock is very inexpensive, though, and so you can make a few mistakes and still not break the bank.

When putting up the sheetrock, you might be tempted to use bits and pieces to save money, but it will be difficult to tape and mud a little later on. Sheetrock is cheap and you should use as big of pieces as you can.

As far as which way to run the sheetrock on the walls, I prefer to run the sheets horizontally so I have a horizontal seam 4 feet up the wall. That makes it easier to tape and mud. The best way to hang sheetrock will leave as few seams as possible. See **figure 14.11**.

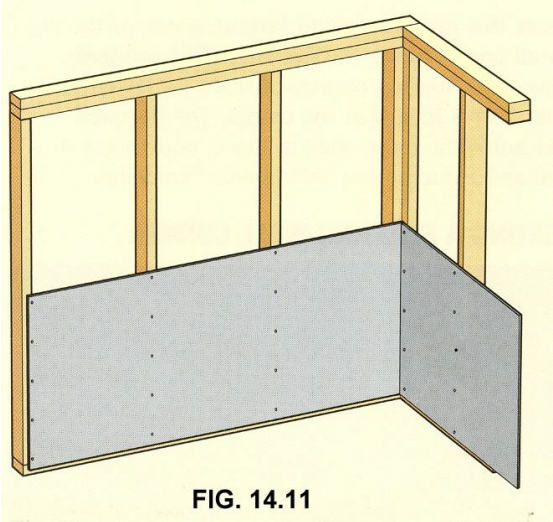


FIG. 14.11

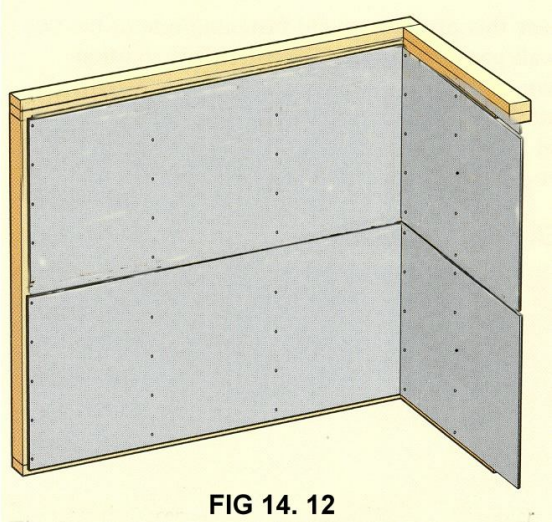


FIG 14. 12

Some people find it easier to install the ceiling sheets with the use of a dead man. See **figures 14.13** and **14.14**

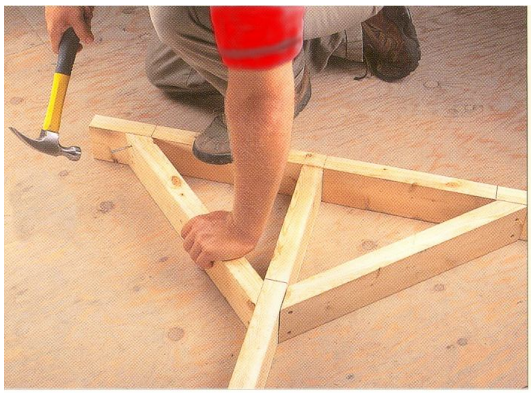


FIG 14.13

FIG 14.14

FIG 14.15

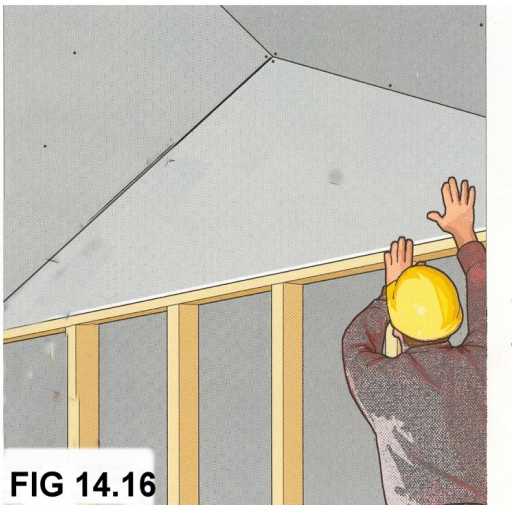


FIG 14.16

A T-square can help make perfect cuts for straight pieces as shown in **figure 14.15**, but a chalk line is usually the best tool for tricky cuts as in **figure 14.16**.

Hanging sheetrock takes a little practice, but it's also a very "common sense" kind of thing. The important thing to remember is to make the taping job easier by using big pieces and getting the sheets to fit together without uneven joints.

After all the sheets are hung, you will need to reinforce the corners with a special kind of tape **figure 14.17** or corner bead **figure 14.18**.

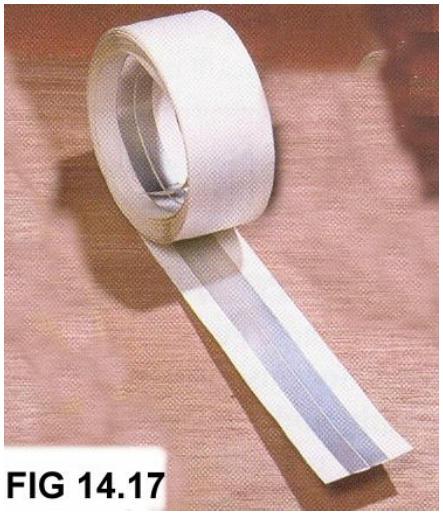


FIG 14.17

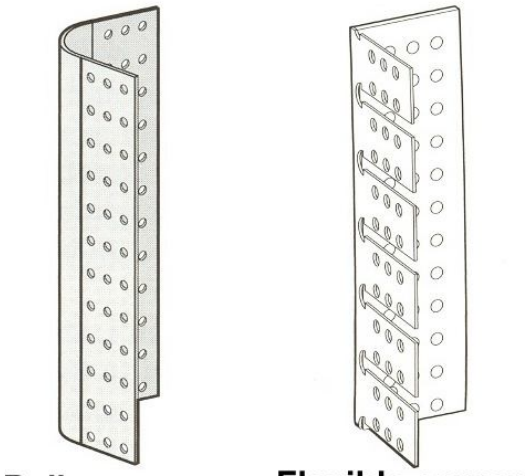
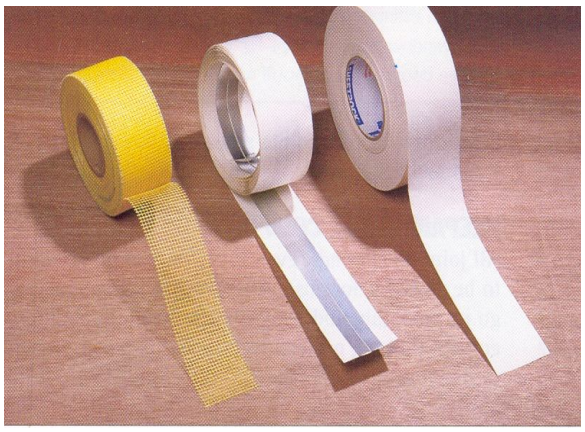


FIG 14.18

The tape folds in half and makes a 90 degree angle or whatever angle you want to make. It is applied the same way normal tape is. It is not as durable as vinyl or metal corner beads. These are nailed in place and are covered with compound. They need to be put on before any other taping because they usually require more layers of mud to hide the seams.

Now it's time to move on to the mudding part of drywall. You will need to prepare the joint compound. I personally prefer the already mixed mud to the dry stuff. The premixed mud will still need to be thinned down with water. This is a trial and error approach, but everyone is a little different in his or her preference to mud consistencies so you will have to find out how thin you like to have it.



Taping is truly an art, which takes a lot of experience if you want to do an expert job. Fortunately, the owner/builder doesn't need to spend years learning how to tape and mud to do a fairly good job. The idea here is to tape the joints or seams and to spread enough layers of drywall compound (mud) over the tape, that the seam is completely invisible under a layer of paint or texture. Most of the tapers start out with a 5 or 6 inch taping knife. They will scoop up a little more than a handful of mud with the knife from the palette. A thin layer of compound is spread evenly along the seam as shown in **figure 14.19**. Next the tape is applied to the mud. It should cover the seam evenly. You will need to slide the tapers knife along the seam to flatten it and squeeze any air bubbles out. See **figure 14.20**.


FIG 14.19

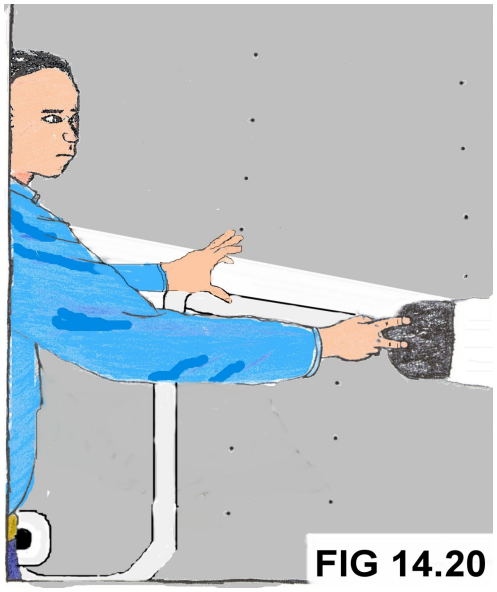


FIG 14.20

You will want to make sure that the tape is exactly the length that is needed because splicing the tape makes a seam that's hard to cover. As you squeeze the compound out from under the tape, make sure to get all the wrinkles and blisters out. If you get blisters or little round bubbles in the tape, you probably aren't getting enough compound on the wall before the tape goes on.

Make another pass with the same knife to get any excess mud out. Let this first layer dry for at least twelve hours. Once that coat has dried, you should use a drywall knife to scrape any burrs or high spots you may have created with the first coat. Be careful not to put gouges in the tape. If you do, just cover it in with mud.

Next, it's time for the second coat or filler coat. This time you will use a 10-inch trowel. Spread an even coat over the first coat that's as wide as the knife. See **figure 14.21**. If the mud is too thick it will crack when it dries. It needs to be just right and sometimes it takes a few do-overs to get it right. Get it as smooth as possible. Make repeat passes until it looks good and is free from high spots and bumps. Let this coat dry for at least 12 hours. Once this coat is dry, remove any high spots and bumps with a tapers knife.

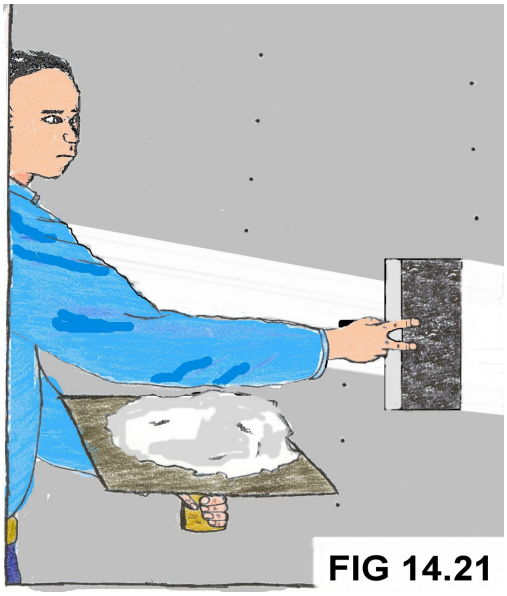


FIG 14.21

FIG 14.22

Now for the final coat or finish coat. Take a 12-inch finishing trowel and spread a light coat of mud over the second coat. Move with long steady strokes while feathering out the sides to make a gentle rounded cover over the seam. You can apply more coats if the seam is still obvious. As far as sanding is concerned, it's a dirty word to the experts, but to the rest of us, we sometimes need to go over our seams and do some sanding in a few places. If you do it right the first time, sanding won't be necessary.

Next, let's move on to corner bead mudding. There are interior corners and exterior corners. The interior corners can be taped with regular paper tape. Some people like to use a corner trowel. See **figure 14.23**. The wall preparation is the same for inside corners as for wall seams.

You will need to apply the mud to the inside corner in a thin layer and then fold the tape down the middle to fit into the corner. See **figure 14.24**.

FIG 14.23

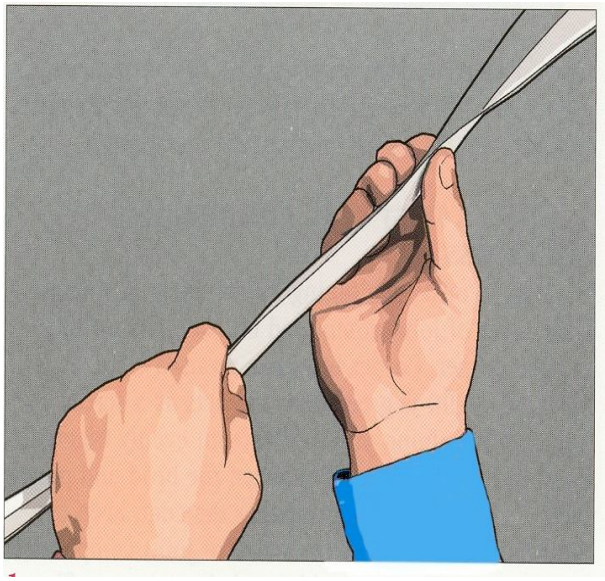


FIG 14.24

Once the first coat is dry you can start the second coat. You will do this with a 5 or 6-inch trowel smoothing the mud into one side of the corner at a time. See **figure 14.25** Once that coat dries you can put a finish coat on.

FIG 14.25

FIG 14.26

We have finished the inside corners and now we can concentrate on the outside corners. After the corner bead has been nailed in place you can apply the first coat of mud. Corner beads don't need tape; they just need to be covered with at least three layers of compound. You just start with the 5-inch trowel and do one side at a time with the first layer, then switch and do the other side covering the entire corner bead with compound. See **figure 14.27** and **14.28**.

FIG 14.27

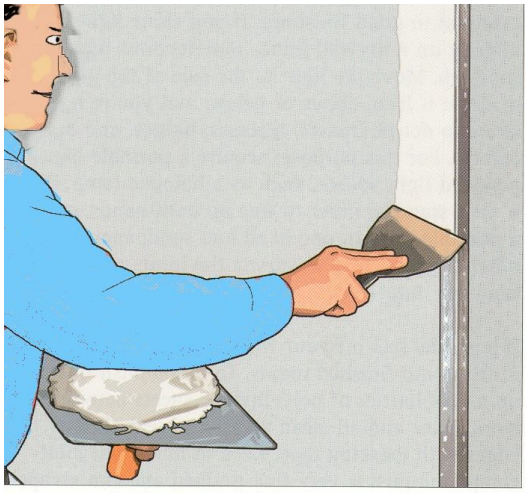


FIG 14.28

From this point it's just the same as inside corners. Make a second application, let dry, and then chip away burrs or high spots, then on to the final coat. See **figures 14.29** and **14.30**.

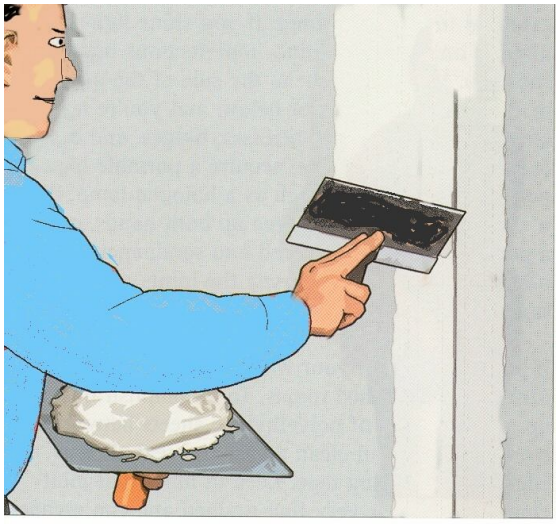


FIG 14.29

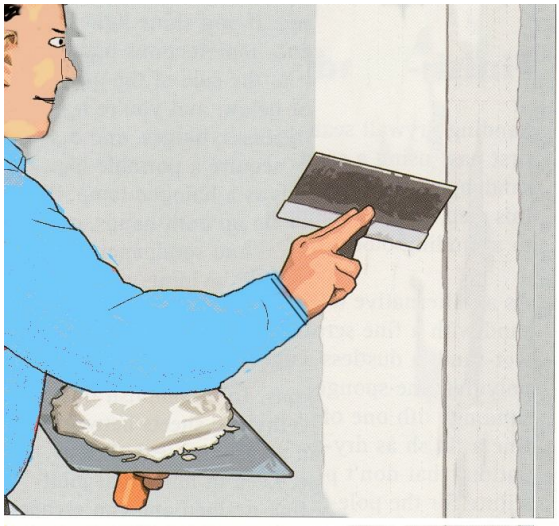


FIG 14.30

Now we'll move on to patching the nail and screw holes. I have found it to be better to run a vertical line down the wall covering a line of screws than to cover each screw individually. This helps to keep a uniform line of mud that's easy to cover.

It’s the same for covering nail holes as it is for mudding seams, except you don’t need tape. If you can put three coats on, you won’t be able to see any nail holes through the texture or the paint. See **figure 14.31** and **14.32**.

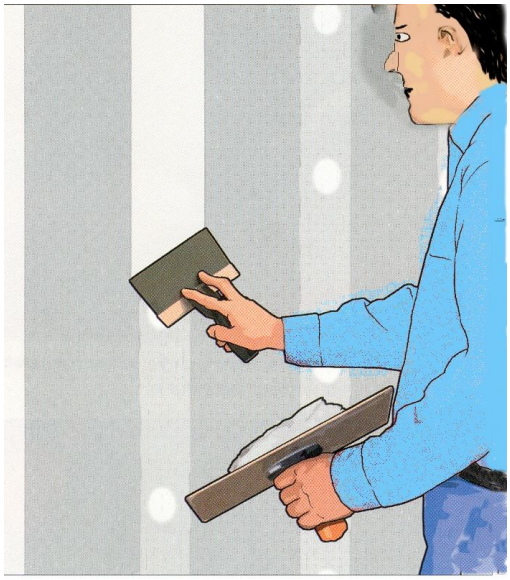


FIG 14.31

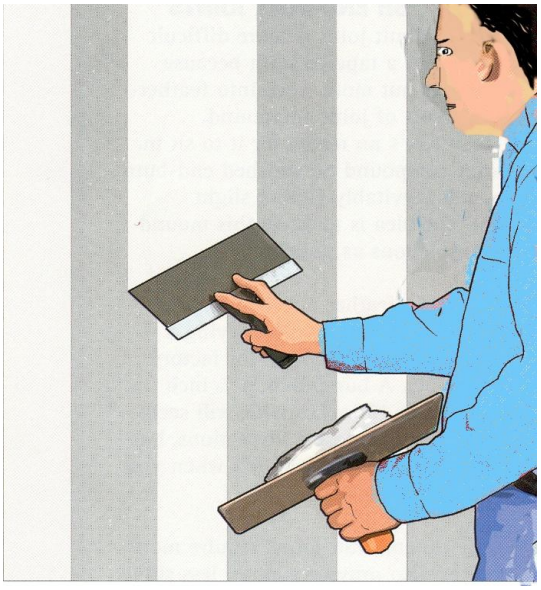


FIG 14.32

The finished project should look something like this. At this point you may want to go back over a few lines and do some sanding if needed.

After all the taping and mudding is done, you will need to decide if you want to texture the walls. Texturing is very popular right now and it's very easy. There are a few different ways to texture your walls, but I'll stick with the easiest way. A hopper and an air compressor make texturing a breeze. You will need to thin down the drywall compound to about the consistency of thick cake batter. Then you connect the air hose and dump the mud into the hopper and pull the trigger. You can either use a hopper or a roller. The hopper saves a lot of time, but you'll need a compressor. See **figure 14.33** and **14.34**.

FIG 14.33

FIG 14.34

You can decide how heavy you want to spray the texture. There are many different designs, but the two most popular are the thick orange peel coat and the flat orange peel coat. The only difference is once you have the coat sprayed on; you can smooth it out with a long trowel or a board making a flat texture. You can also make designs with the compound. See **figure 14.35** and **14.36**.

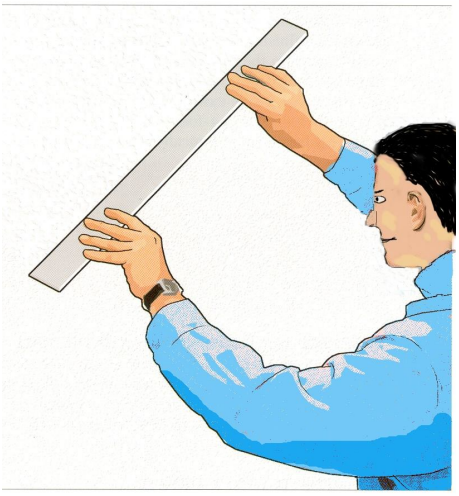


FIG 14.35

FIG 14.36

If you decide to make designs with the drywall compound, just remember that when it hardens it can leave jagged edges. Ceiling designs are usually a great idea but wall designs within reach might need to be flattened to smoothen out the sharp edges.

That’s about all for drywall. The house will be stronger, quieter, and it will have a finished look.

FIFTEEN

Floor Finishes

To continue in the building process, we need to finish the second layer of the floor. The first layer was put on when we did the framework. The floor joists were covered by a layer of plywood called the sub floor. This layer of plywood is the only layer of flooring up until the finish work gets started. We don't put the second layer on immediately after the first layer because it can get damaged by building materials, careless workers, and weather.

The second layer of flooring is called the "under layment". It is usually either particleboard or plywood. It doesn't matter which one you use. **See figure 15.1**

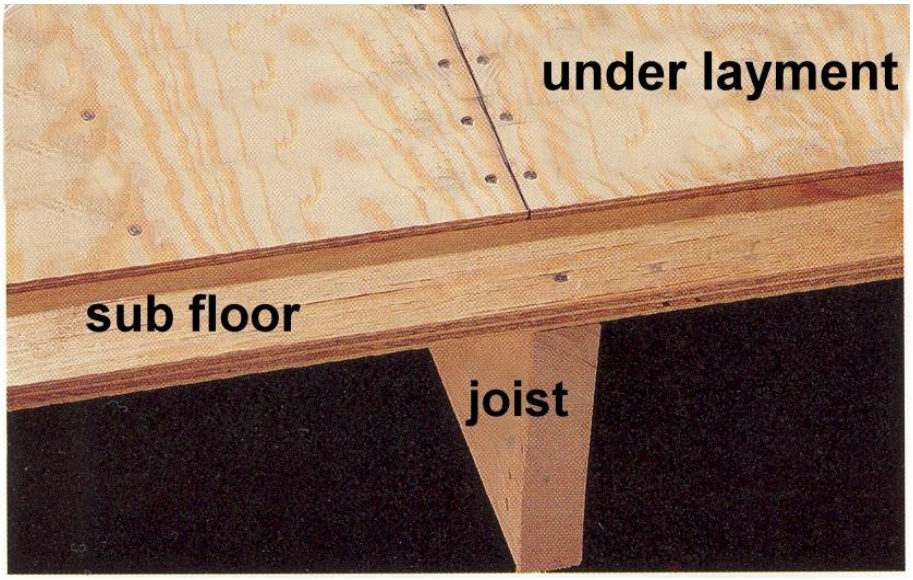


FIG. 15. 1

You will want to get a good fit with the under layment. This is one of those areas where you will be cussing yourself if your foundation is out of square. It's really important to get a good fit in the more open areas of the floor. Gaps can be filled with flooring putty to prevent uneven areas that can cause excessive wear on carpets and even make holes and bare spots.

Screws help hold the sub floor and the underlayment together better than nails to prevent squeaky floors.

The second layer of flooring will make the floors much stronger. It's definitely a lot of work to fit each piece into place especially around toilet flanges and up against the walls.

When this is completed the floors will have a consistent flow from one room to another. This gives the home a more completed look and feel.

Once the second floor is done, we can start preparing for the floor coverings and finishes. There are several options to choose from and they are all fairly close in cost. We can choose carpeting, wood flooring, vinyl (linoleum), or tile. Some kinds of wood flooring are very expensive, so be sure to shop around for good quality, but a good price. If you go to a flooring store, the salesmen will probably try to sell you something pricey. If you have a Lowes or a Home Depot handy, any of the salespeople will help you find something of good quality that's in your price range.

There is one thing that I should mention here about carpeting. Most carpet stores sell carpet by the square yard, but the installation is already included in the price. I tried to find carpet that I could install myself, because I thought it would be cheaper, but the price was the same if I did the work or not. This is very common. It's much easier to have the carpet installed for you and it's usually the same price. **See figures 15.2** and **15.3**.

FIG 15.2

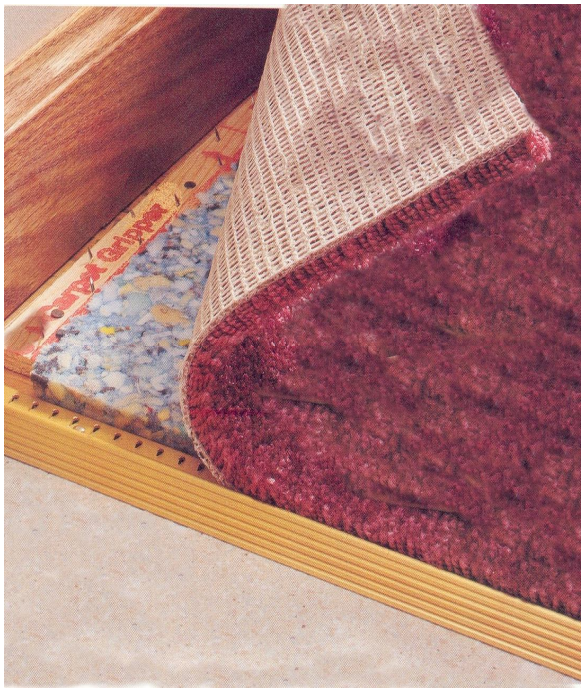


FIG 15.3

Carpet is really quite reasonable unless you decide to buy an expensive brand, which will last longer, but even the more economical type will last close to a decade. By that time, you'll probably be ready for a newer style, so the less expensive brand is a good idea. Heavy traffic areas like hallways and entryways will need a durable type of carpet. Try to get a good deal on carpeting because there is a wide variation in price.

FIG. 15.4

FIG 15.5

You will need the carpet pad, which goes down first. See **figure 15.4**. You will need to nail all the tack strips in place, which actually holds the carpet in place without having to use tacks. The tack strip will be placed ¼-inch away from the walls. See **figure 15.5**

FIG 15.6

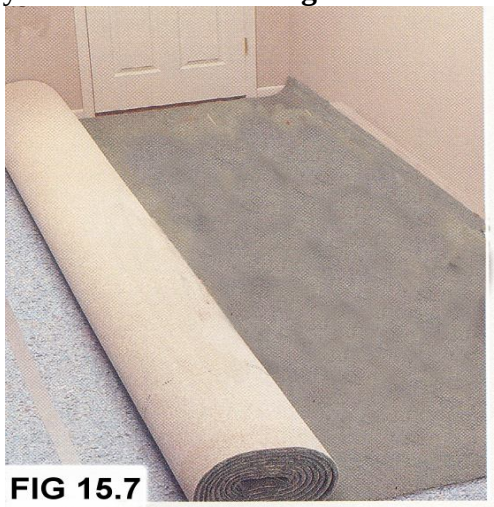


FIG 15.7

The carpet pad will fit inside of the tack strip. The carpet roll can now be rolled out onto the floor to be measured for cutting. See **figure 15.7**. There needs to be about three inches of spare carpet all the way around before cutting it. This is the first measurement and it needs to have extra. Once that is cut to a rough estimate, you will need to get a carpet edge cutter or a utility knife. See **figure 15.8**. An edge cutter is preferable because of its ability to cut straight lines up against a wall. You can still get a good close fit with a utility knife, but you need to be much more careful not to cut too much carpet or it will leave a bare spot. This is a time when it is essential to have good sharp blades for your utility knife.


FIG 15.8

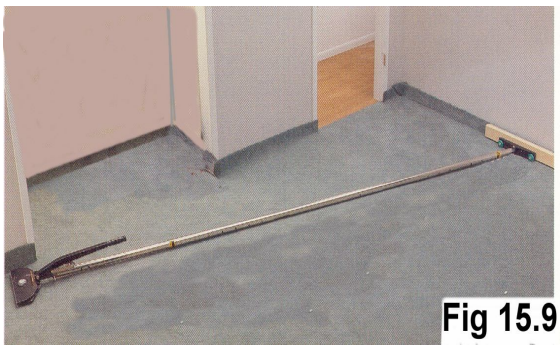


Fig 15.9

The carpet will need to be stretched tight with a stretcher as shown in **figure 15.9**. Once it is stretched tight, you can start to press it into the tack strip with the head of a hammer. You can secure the carpet onto the tack strip by rolling the hammer head firmly along the strip and pressing down. This will push the carpet onto the strip and bend the strip tacks over to hold the carpet in place. You can then lightly hammer the tack strip to make sure there aren't any tacks sticking through.

That is the nutshell version for carpets. As I said before, you will probably not have to do your own carpets because the price is the same if you do it or if you let somebody else do it. Laying carpet takes a fair amount of experience, so it's best that the professionals do it anyway.

Let's take a look at wood flooring. This is quite expensive no matter what kind of quality you get, but definitely shop around for the best price. Wood laminates is the most economical route to take as opposed to the real expensive hard wood flooring. See **figure 15.10**. You can use solid wood for a little more money as in **figure 15.11**.

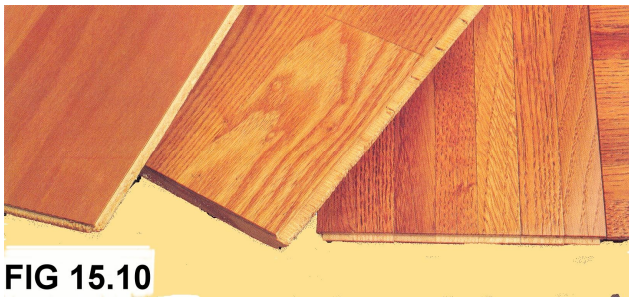


FIG 15.10


FIG 15.11

The important thing to remember about wood flooring is to get the floor marked accurately with either a marker or a chalk line. The floor needs to be marked in a grid pattern that is in square. For laminated squares, you will start in the middle of the floor and work towards the walls. That way, when you have to cut a tile to get it to fit up against the wall, it won't look bad. If you start from the wall and work your way to the middle, you'll end up with an odd-sized tile or tiles in the center for everyone to look at.


FIG 15.12


FIG 15.13

After you've marked the floor then you can apply the flooring adhesive with a notched trowel. The adhesive dries fairly quickly so you might want to cover only as much of an area that you can work on inside of an hour. See **figure 15.12**. Next you will start laying the tiles in place according to the measurements on the floor. See **figure 15.13**. Some types of floor laminates need to be glued. Once in place, make sure they fit tightly together.


FIG 15.14


FIG 15.15

Tap them gently with a piece of scrap wood and a hammer to make them fit tightly together as shown in **figure 15.14**. You can make special cuts for the final tiles with a jigsaw or a coping saw and place them in until you have a perfect fit. See **figure 15.15**.


FIG 15.16

Once you've finished putting it all together, you can go over it with a damp cloth to get all the glue. It should come off easily with water.

For areas where there will be a lot of moisture like kitchens and bathrooms, it's a good idea to use cement board or more commonly called "backer board" on top of the underlayment flooring. This will protect the plywood floor from water damage. You will need to put a layer of thin-set mortar mix down with a ¼-inch notched trowel. See **figure 15.17**. Backer board can be fastened with 1 1/2-inch galvanized screws. See **figure 15.18**.


FIG 15.17


FIG 15.18

Once you get the backer board screwed down, you will need to put another layer of adhesive for the tiles. See **figure 15.19**. Ceramic tile is perfect for humid environments. See **figure 15.20**.


FIG 15.19

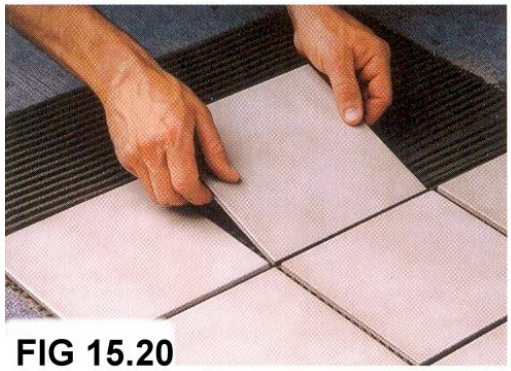


FIG 15.20

It helps to use spacers on ceramic tile to keep them even. See **figure 15.21**. Smaller tiles usually come on a mesh screen so they stay uniform without spacers. See **figure 15.22**.

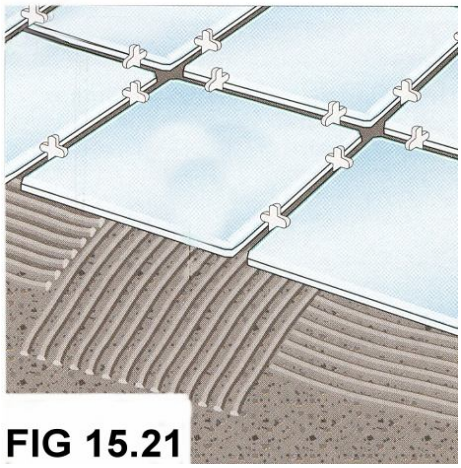


FIG 15.21

FIG 15.22

Once you've secured the tiles and let the adhesive dry a bit, you can apply the grout. Grout is a special type of cement that you spread into the cracks between tiles. See **figure 15.23**. It helps to tilt the float trowel a bit to push the grout into the cracks. When the grout has evenly filled the cracks, you can remove any excess grout by wiping the tiles with a damp sponge. Do this very lightly and just enough to remove the excess without pulling any grout from the cracks. See **figure 15.23**.

FIG. 15.23

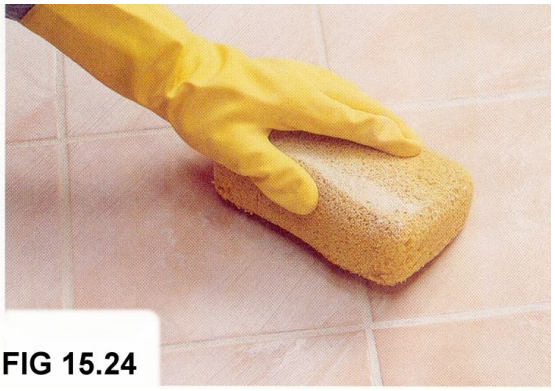


FIG 15.24

Vinyl tiles are also an option for floor covering. They are quite inexpensive and very easy to put in place. They aren't nearly as durable as wood or ceramic tiles though. Vinyl tiles are available in many styles and colors. They are also available as self-adhesive tiles where you just peel off the wax paper and lay them in place, or you can get the dry-back vinyl tiles where you need to put a layer of glue down and stick them in place. See **figure 15.25**. You can also go for the option of sheet vinyl (linoleum). It's harder to put in place and you have to be precise when you put it onto the floor because the adhesive will usually hold it in place once it is down. See **figure 15.26**.

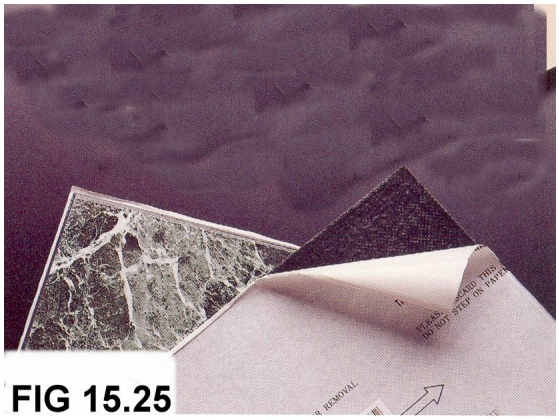


FIG 15.25

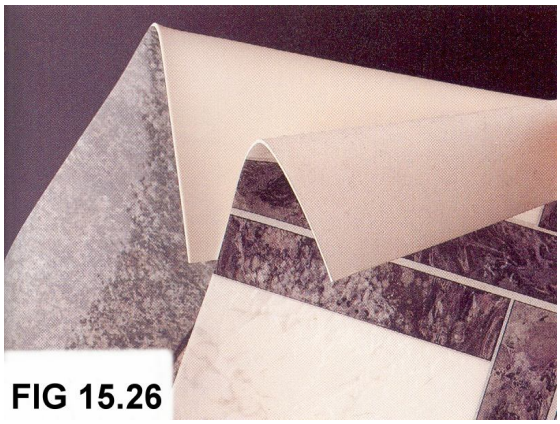


FIG 15.26

Sheet vinyl needs to be glued in place but it is much more durable than vinyl tiles because there are no seams to wear or come loose. The floor preparation for sheet vinyl is a little more demanding as every crack and hole in the plywood underlayment needs to be filled before the adhesive can be spread on. The best way to put on the vinyl is to spread it out onto the floor before you put on the adhesive and make sure every corner has a perfect fit. Once you have it just right, pull back half of the vinyl and then put the adhesive down in front of the vinyl with a notched trowel. See **figure 15.27**.
Lay the vinyl back onto the adhesive, then pull back the other half and do the same thing. Once it's in place, you will need to use a roller to flatten any air bubbles. See **figure 15.28**.

FIG 15.27

FIG 15.28

When you have all the flooring done, you can put threshold strips across doorways to prevent the vinyl from peeling up. It also keeps carpets from fraying. See **figure 15.29**

FIG 15.29

Well, that's all we need to cover for flooring. Most flooring is very easy to install and with the new kits available at the flooring retail stores, you can do a professional looking job with no previous experience.

SIXTEEN

Bathrooms and Fixtures

Bathrooms is a fun part of the whole building project because it goes quickly and looks so good when it's all finished. The hardest part of bathrooms is the plumbing and at this point, most of it has been done.

The fixtures and components in bathrooms can be really expensive or really cheap. What we want to look for is something that has a low price, yet is of good quality. You can find good quality products at a fair price at most building stores if you shop around. The fixtures and components you'll want to find for your bathroom are a toilet, a bath, a shower, mirrors and cabinets, lights, a sink, a fan, faucets, handles and switch plates.

Bathroom cabinets are usually considered as a part of kitchen cabinets if you have a cabinetmaker build your kitchen cabinets. The cabinetmaker will need the dimensions for any bathroom cabinets you have.

To start off, we need to make sure the walls have adequate protection against moisture. Regular sheetrock can be used, but in bathrooms, it is becoming more and more common to use cement board or backer board for the walls. This not only protects against rot and mildew, but is also a solid surface to attach tile and tub and shower surrounds to. See **figure 16.1** and **16.2**.

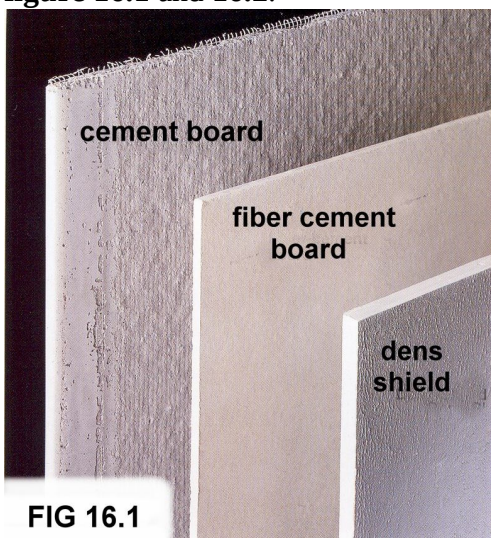


FIG 16.1

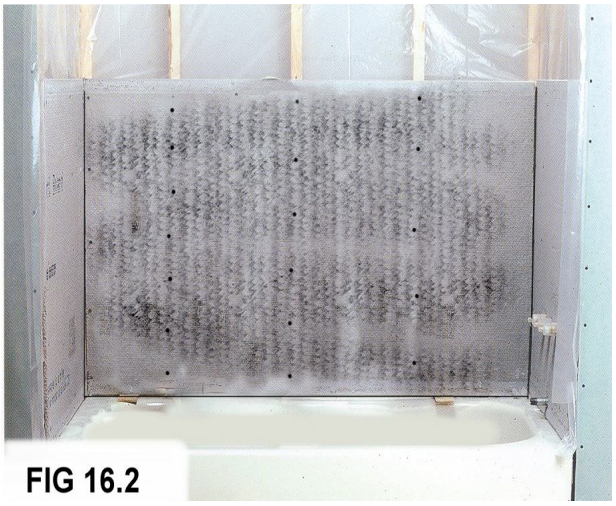


FIG 16.2

Cement board can be taped with a special fiberglass mesh tape and latex cement. It doesn't need any more than one coat. See **figure 16.3**. A tiled bathroom wall can be absolutely gorgeous if done correctly. See **figure 16.4**

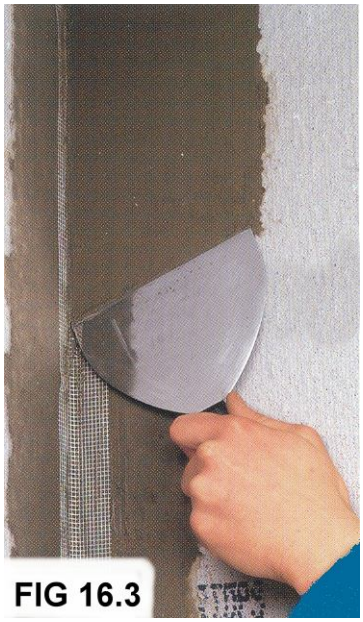


FIG 16.3

FIG 16.4

Cement board and backer board is the same thing. It really helps make a stable wall to attach tile to.

Next, we'll move on to the installation of the bathroom fixtures. The toilets are very easy to install. As part of the plumbing you'll see the toilet flange with two bolts sticking out of the floor where the toilet will go. See **figure 16.5**. Before you put the toilet onto the

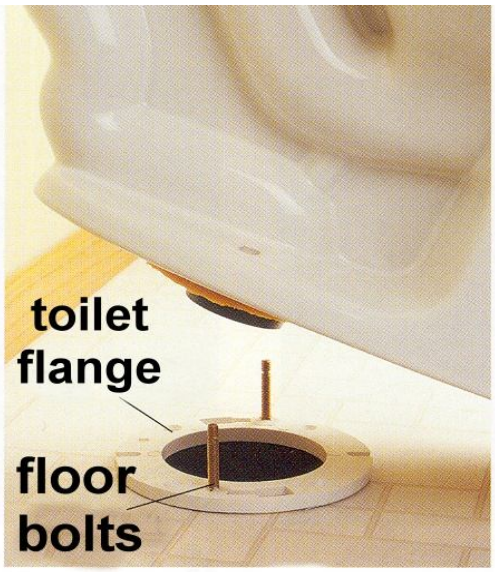


FIG 16.5

FIG 16.6

flange, you will need to put a wax ring onto the bottom of the toilet. You can get wax rings and sleeves at any plumbing store. After you apply the wax ring and sleeve as shown in **figure 16.6** you can then place the toilet on to the flange bolts. You should push down on the toilet so the wax ring makes a good seal. Next you will put the washers and nuts on and secure the toilet. Over tightening can break the porcelain, so be careful to get it just right. Next you will put on the trim caps and you are done with the toilet bowl. See **figure 16.7**. Next, you'll put the tank on. You need to make sure that the holes line up before screwing them in place. The flush valve and bolts will fit into the holes.


FIG 16.7

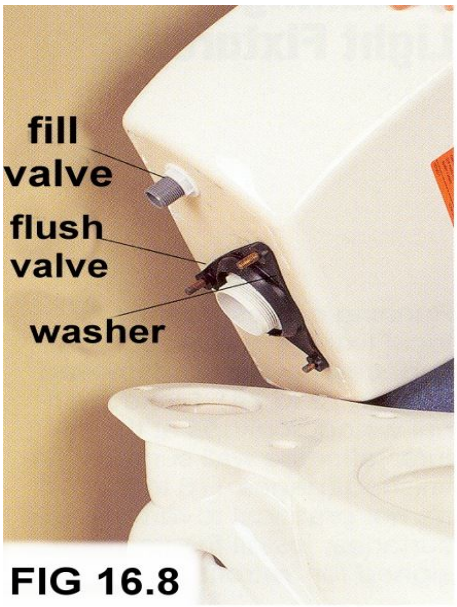


FIG 16.8

Figure 16.8 shows how the tank will fit on to the toilet and where the screws need to be secured. **Figure 16.9** shows where the bolts will be tightened and **figure 16.10** and **16.11** shows the connection of the waterline and the toilet seat. And that is it.

FIG 16.9

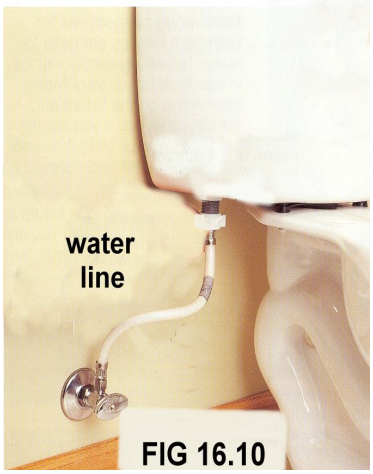


FIG 16.10

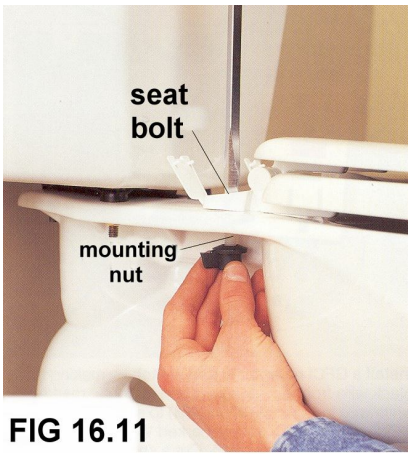
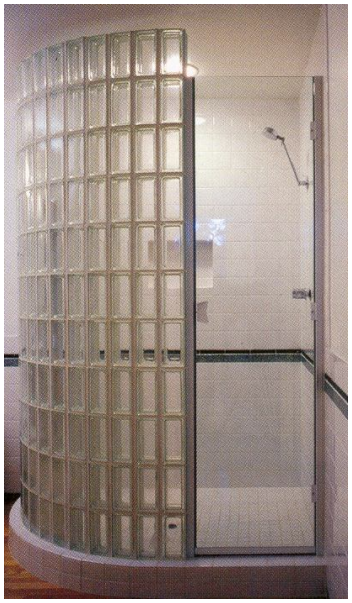


FIG 16.11

Let's move on to something a little more difficult, the shower. The problem with freestanding showers is that they have a tendency to leak. There are many different kinds of shower stalls. Most of them rest on top of a pan that connects to the wastewater plumbing lines underneath. If the pan isn't adequately secured, the plumbing connection will leak over time because of the weight shifting around every time someone uses the shower. That's bad news particularly if it's an upstairs shower.



There are a few ways to make these showers leak proof. **Figure 16.12** shows a cutaway diagram of the shower pan and the drain fittings. **Figure 16.13** shows the drain cover, rubber gasket, and drain tailpipe. The tailpipe fits into the p-trap and the gasket around the drain keeps the pan leak proof.

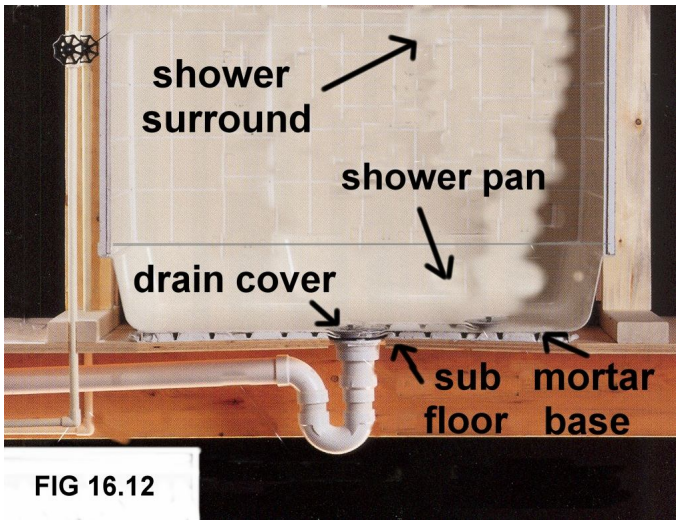
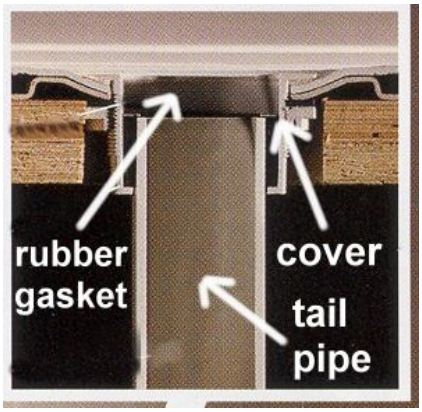


FIG 16.12



Now let's lay the mortar to show how it needs to be done. The shower pan should be ready to put in place. Make sure you have the drain cover, rubber gasket, and tailpipe installed and it is tightened down with a drain collar nut. See **figure 16.14**

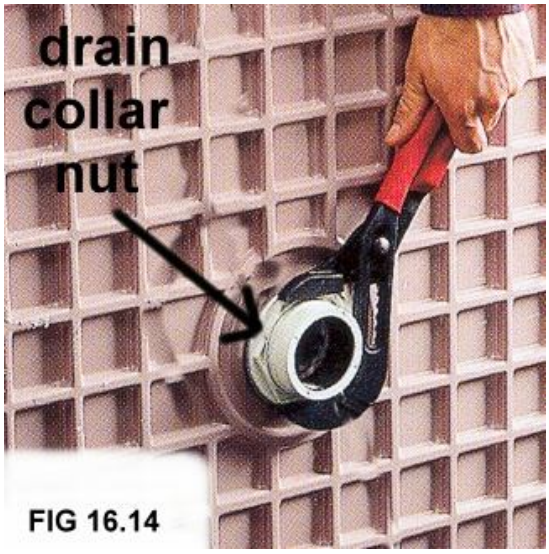


FIG 16.14

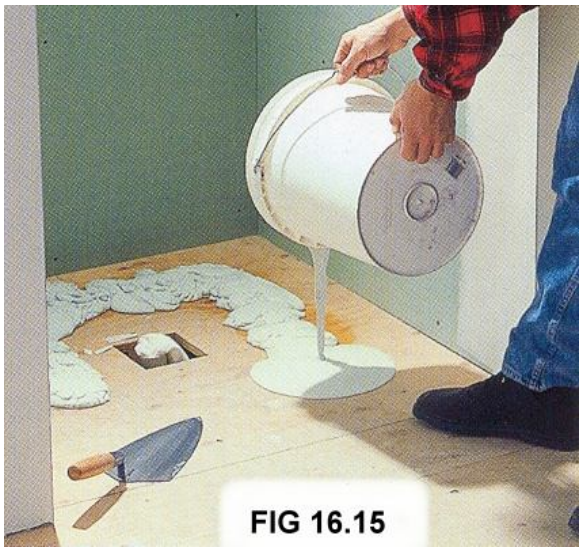


FIG 16.15

Pour about a 1-inch thick layer of dry-set mortar. See **figure 16.15** Make it even and then rest the shower pan on it making sure that the tailpipe is in the p-trap. Sometimes it helps to put some dish soap around the drainpipe in the floor and on the rubber gasket on the drain tailpiece. Push down on the shower pan especially hard immediately around the drain so the rubber gasket makes a good seal around the drainpipe. Let it sit for about ten hours before you put on the surround. The surround goes on easy, but you may want to put up a template so you know where to cut out the handle hole. You can use adhesive to attach the surround to the backer board on the wall. See **figure 16.16**.

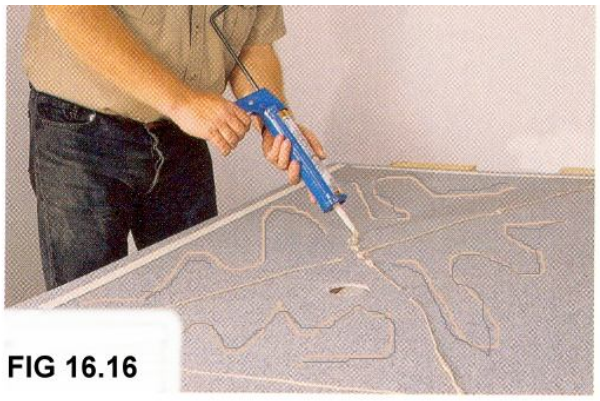


FIG 16.16

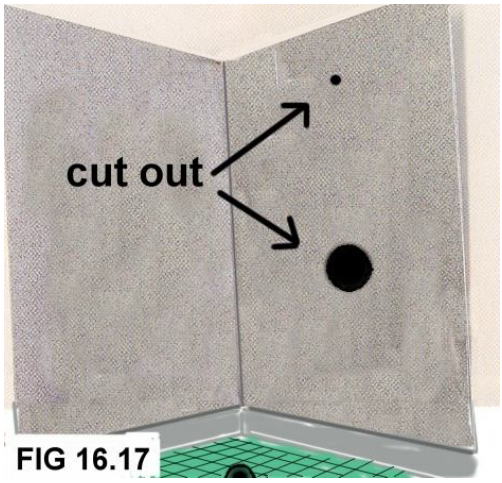


FIG 16.17

You can probably work on the plumbing through the shower surround regulator hole, but it's easier if you do it before the surround goes on.

You will need to install the anti-scald valves on the shower control stem, but most shower assemblies come already put together with the device in place. See **figure 16.18**. Anti-scald valves are now a mandatory code in all fifty states.

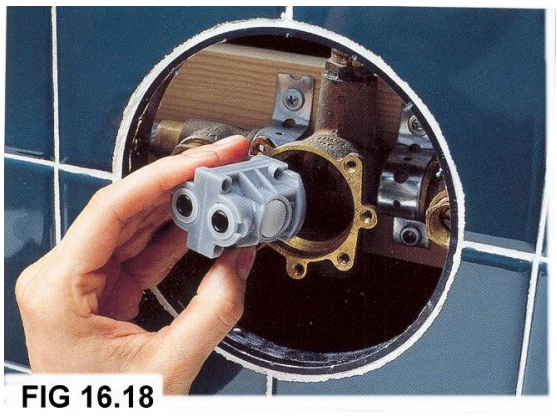


FIG 16.18

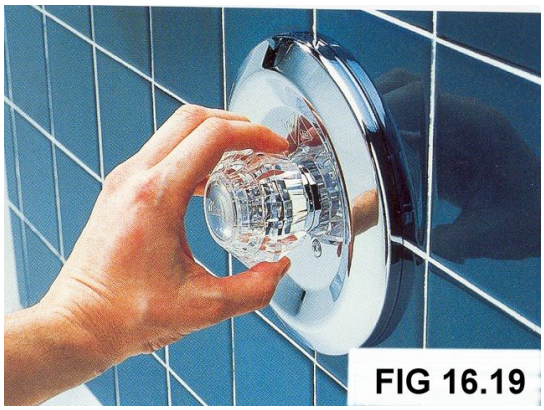


FIG 16.19

Every building center has the right parts for shower and bath anti-scald valves so don't worry about getting the wrong parts. It would be difficult to find shower pipes without anti-scald valves these days. The shower handle assembly comes with a cover that fits into the cut out hole in the surround. The top of the handle comes off and under it is a screw for tightening the handle. You just pop the top back on when it's done.

We have covered shower pans and surrounds, now let's briefly talk about tile work. Tile is becoming very popular and for a good reason. It has unrivaled beauty if done correctly, and it's not that expensive to do yourself. If you hire it out, it will be pricey because it takes a lot of labor to install. Still, tile helps hold the homes value like nothing else because of its durability. Let's see what we have to do to make a tile shower. First we have to make a box and put building paper down. Glue the bottom piece of the three-piece shower drain with PVC cement or ABS cement if using ABS. See **figure 16.19**.

FIG 16.19

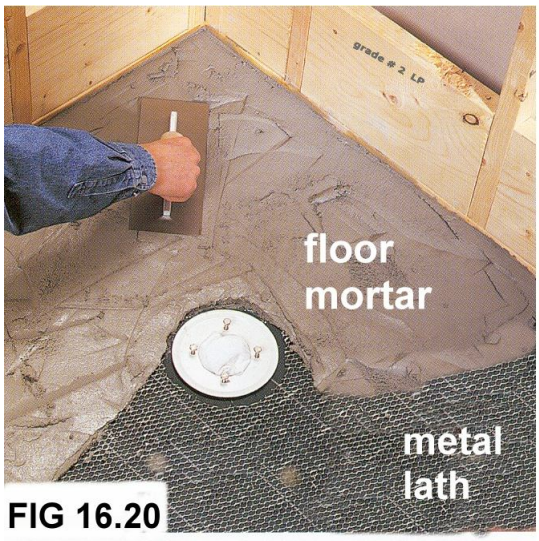


FIG 16.20

Next, you probably should put a rag into the drain hole to prevent mortar from getting in. If you can find metal lath, staple it in place. This helps make the mortar much stronger. Now, mix the floor mortar with a latex additive to make a mixture with the consistency of soft modeling clay. You will want to mark a level line around the box as high as the mortar will be. The idea is to make a gentle slope from the outside down to the drain. Try to get the mud even all the way around as it slopes inward. Next put the screws into the drain assembly. There is a new type of rubber sealant that is very popular for this type of stuff called CPE membrane. Just stretch the rubber over the mortar and cut the rubber where the screws are so they stick out. Stretch the membrane over the sides of the box and staple it high where the backer board will cover it. See **figure 16.22**.

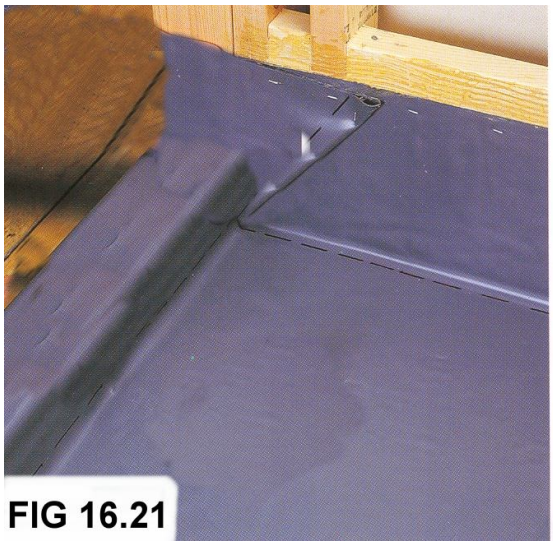


FIG 16.21

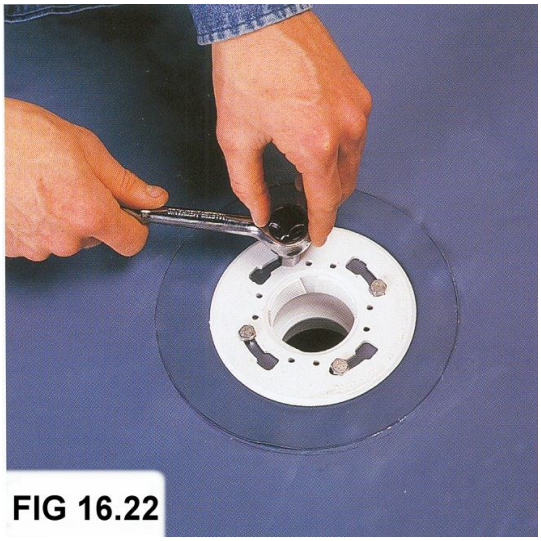


FIG 16.22

You can reinforce the membrane over the drain if you want to for more strength. Now screw the middle drain piece down evenly and tightly to make a watertight seal. See **figure 16.22** Next, we put the backer board on the walls and put the third drain piece in.

FIG 16.23

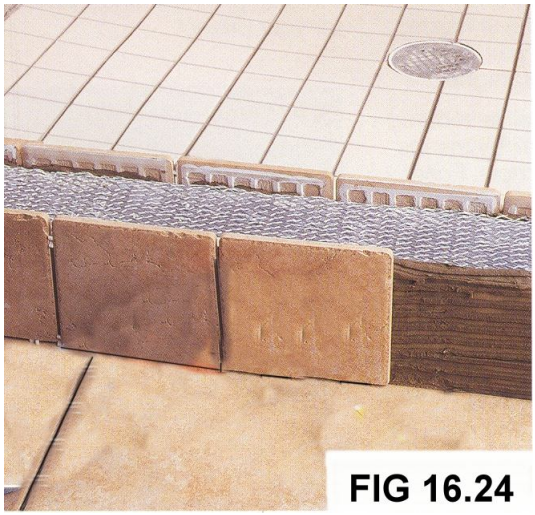


FIG 16.24

Lay out another layer of mortar while keeping in mind that the tile needs to be just slightly above the drain when it's installed. This will help us remember how high to make the mortar. Let this dry overnight and then we can start with the tiles. It's easier to get the sheets of tiles than to do one at a time. From this point, it's just a matter of securing the tile and grouting in the cracks. See **figures 16.25** and **16.26**.

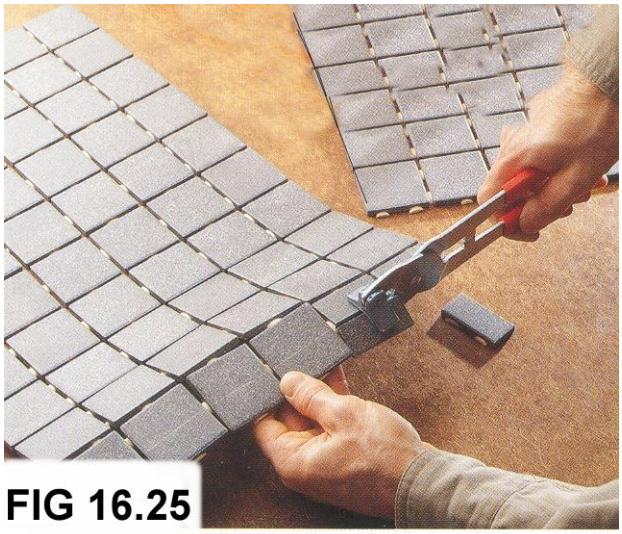


FIG 16.25

FIG 16.26

After the grout has had a short time to dry, you can clean away any excess grout. That's about it for a tile shower. It seems like a lot of work and it is, but you will enjoy it for years to come.

Installing the showerhead is the easiest thing yet. You will want to wrap the threaded end of the shower arm with Teflon tape and then just screw it into the shower pipe assembly inside the wall. See **figure 16.27**and **16.28**.

FIG 16.27

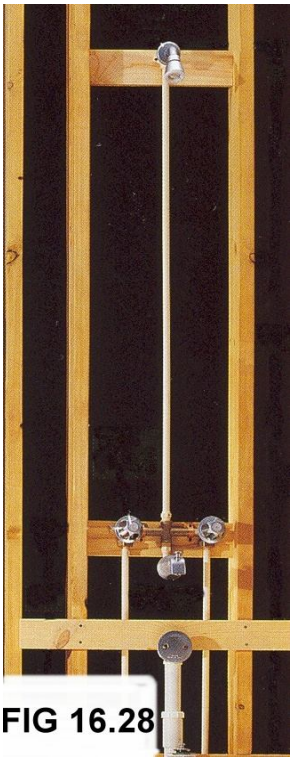


FIG 16.28

Now, let's move onto baths. Baths are easier than showers because they are self-contained and there aren't many places where a bath can leak. We'll start out with a simple tub, which you install. Some have surrounds and some don't.

The bathtub plumbing fixtures will already have been installed at this point. It's just a matter of hooking up the water supply to the correct handles and the drain waste assembly to the septic system. The drain waste is an assembly piece that covers the drain and the overflow hole in the tub. See **figure 16.29**

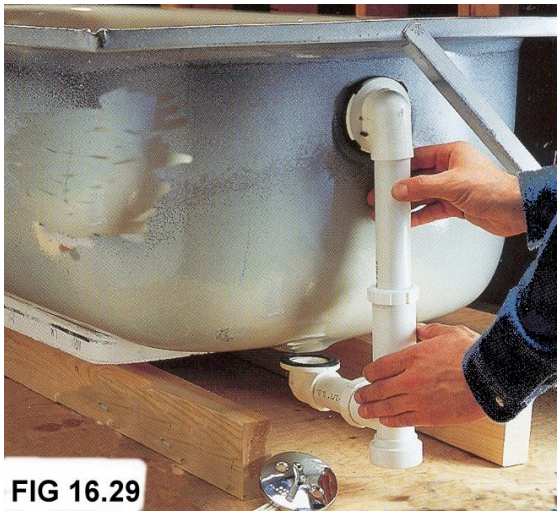


FIG 16.29


FIG 16.30

The overflow is attached by inserting two screws through the overflow plate and the drain is secured by screwing it into the drain waste assembly to make a water tight seal See **figure 16.30**.


FIG 16.31


FIG 16.32

The faucet handles and faucet just screw into the bath plumbing assembly and the handles usually have a screw on the top to secure to the pipes in the wall. See **figures 16.31** and **16.32**.

Next we will need to move on to bathroom sinks. We will already have the plumbing all set up and waiting for the sink just like the other bathroom fixtures. Most bathroom sinks fit into specially made cabinets, but some are freestanding. Connecting the plumbing is quite easy. All it entails is to connect the drain line to the septic line and it needs hot and cold-water hook-ups.

Most sinks have the p-traps installed immediately under them and it fits into the cabinet, but some freestanding sinks have the p-trap built into the walls or floors so you can't see them. Usually toilets, showers, and bathtubs already have the p-trap installed because it's part of the rough work, but for bath and kitchen sinks, the p-trap will most likely need to be installed after the walls have been finished and the cabinets have been made.

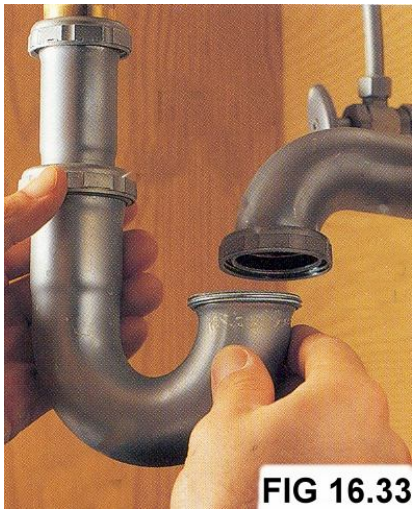


FIG 16.33

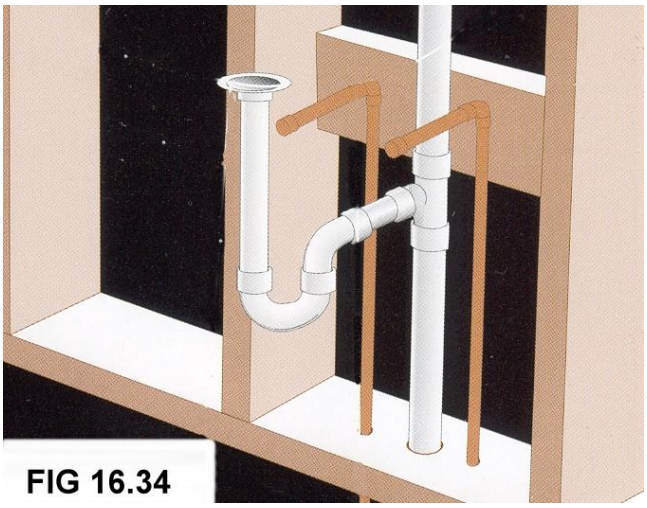


FIG 16.34

Figures 16.33 and **16.34** show how the p-trap assembly is connected to the septic line. The sink will next need to be put into a cabinet. The one-piece sink and counter top is very popular these days. See **figure 16.35**


FIG 16.35

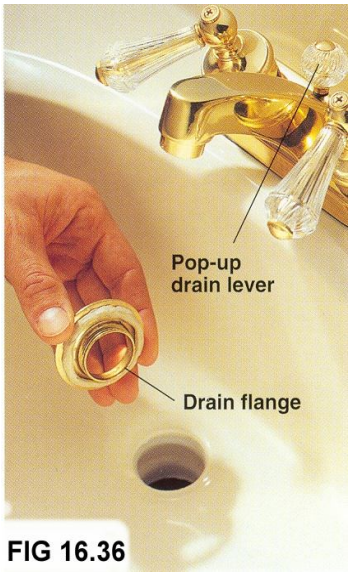


FIG 16.36

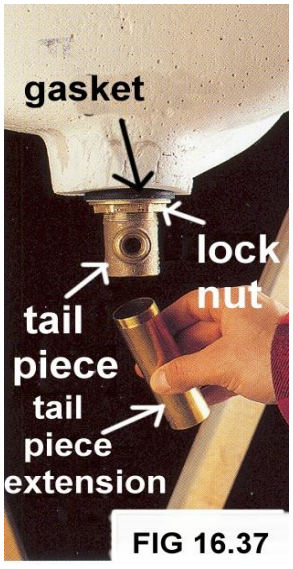


FIG 16.37

As we can see in **figures 16.36** and **16.37** the drain connects with the tailpiece. The tailpiece is held onto the sink with the underside locknut. The tailpiece extension then goes into the p-trap.

Next we need to make the hot and cold-water connections. We'll have to first secure the faucet to the sink by screwing on the locknuts on each water intake. In **figure 16.38** we can see the faucet with both intake valves. This will fit through the holes in the sink. After we tighten down the lock washers, we will put on each water line.


FIG 16.38

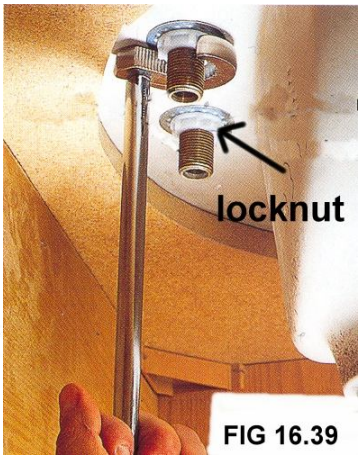


FIG 16.39

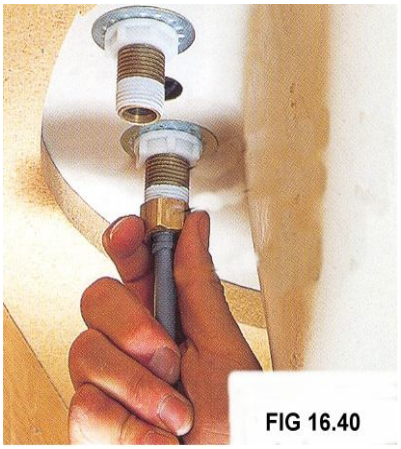


FIG 16.40

You will need two supply tubes. These tubes come in different lengths and they come in plastic or metal. They have fasteners at each end so they can screw onto the sink intakes and the plumbing waterlines as shown in **figures 16.39** and **16.40**.

Now, lets move on to bathroom fans. These fans can be put in as part of the finish work, but as usual, the venting should have been done along with the HVAC before the insulation and sheetrock was put up. Bathroom fans are important for more than the most obvious reason, they also pull moisture out of the air and deliver it outside. This helps prevent mold from growing in humid places. They are a snap to install if you use dryer vent. When installing the dryer vent, you'll need to be careful not to twist or kink it. There is usually one exhaust vent on the roof or the side of the house in medium sized houses.

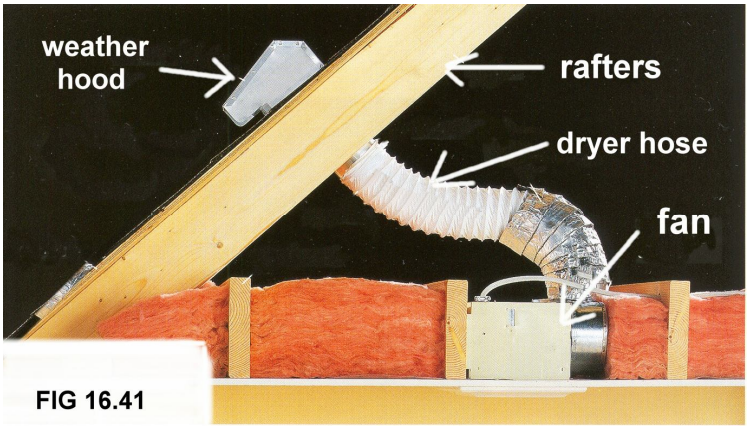


FIG 16.41

You'll first need to cut a hole in the roof the size of the vent flange. The vent cover will completely cover the hole and the flange will stick into the hole and connect to the dryer vent. See **figure 16.42.** Connect the dryer vent with a hose clamp as in **figure 16.43**.

FIG 16.42

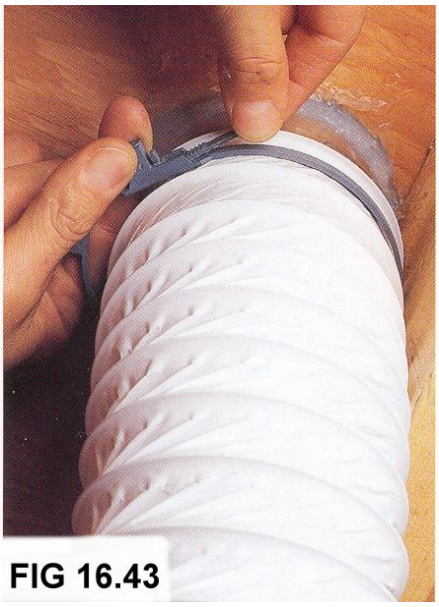


FIG 16.43

Connect the other end of the dryer vent to the fan outlet using another hose clamp. The wiring should have been run with the electrical so it's just a matter of connecting the hot and neutral wires. See **figure 16.44**. Some fans are a fan, heater, and a light. In this case you will have three sets of wires to keep straight and run to a switch or switches as we've covered in chapter 9. Remember that all bathroom outlet switches need to be GFCI's. See **figure 16.45**

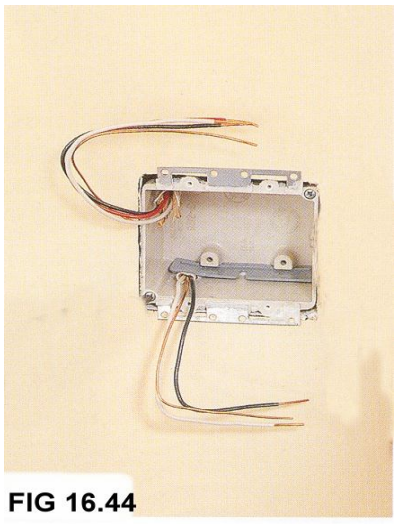


FIG 16.44

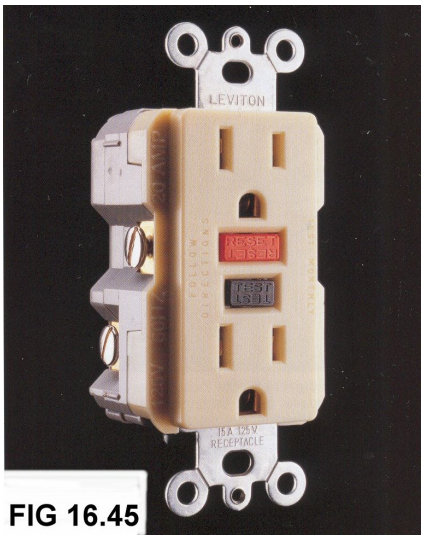


FIG 16.45

Well that's it for the installation procedures of the fixtures for bathroom components.

SEVENTEEN

Kitchens and Cabinets

Kitchens are fun and beautiful. They are also really expensive. The kitchen will be the most expensive room in the entire house to build. The reason for that is the cabinets.

My purpose for making a book on house building is to pass on what I have learned about the cost of labor and how we can save hundreds of thousands of dollars in the long run by doing the work ourselves. This is an area where we have to step back a bit and analyze things a little though.
After calculating the expenses of building my own cabinets, it was about the same to have them made for me. Also, kitchen cabinets are such an important focal point to appraisers and future buyers. They need to look good.

There are a lot of specialized cabinet-making tools that are really expensive to buy and almost impossible to rent. So what is an owner/builder supposed to do?

There are several options of varying cost and labor. First, you could really shop around for the best prices from cabinetmakers. There is a fair amount of competition out there, but most cabinetmakers seem to stay busy. Still, if you're careful you can find the right price and the right quality. For a 2000 square foot dwelling you should be able to get your cabinets made for $5000-$10,000. We was able to get our cabinets made for $6500. The quality of the cabinets and the installation was perfect. It saved me a lot of time and I'm sure our final appraised value was higher than it would have been had I made the cabinets.

There are more options now than there have ever been. You can now get cabinets as components at Lowes, Home Depot, or almost any other building center. The cost is much less to do it this way, and the results are usually quite good. You can also get RTA cabinets. It means ready-to-assemble. They are shipped to your building site in flat boxes and you assemble them. This has also been an inexpensive option, but you need to make sure you're getting quality before the boxes show up.

Another option is to build the cabinet boxes (better known as carcasses) yourself and buy the doors from either a cabinet maker or a building center.

There are a few things to watch out for though. No matter how much money it will save, you should never get cabinets made entirely of particleboard or any similar substrate material. It won't pass the test of time and appraisers will knock extra points off the value of your house. They think that if you're willing to cut corners on the visible areas, then you've probably done it on the less visible parts of the house. Most countertops are made of particleboard so that's fine.

I won't go into depth about how to build kitchen cabinets from start to finish. I will however assume that some people will want to learn as much as they can to save as much money as possible by doing most of the work themselves.

A good place to start is with the dimensions of each cabinet including appliances. This gives a good idea how big to build our kitchen. There are standard sizes to each cabinet. If you have to have one specially made to fit in a corner or to make everything fit right, it will cost a lot extra. That's why careful planning and a little foresight make things work out well in the end. It's best to design your kitchen dimensions around the standard sizes of the cabinets.

There are basically four types of cabinets; they are the base, wall, oven, and pantry cabinets. The kitchen sink cabinet will entirely depend on the length and width of the sink See **figure 17. 1**.

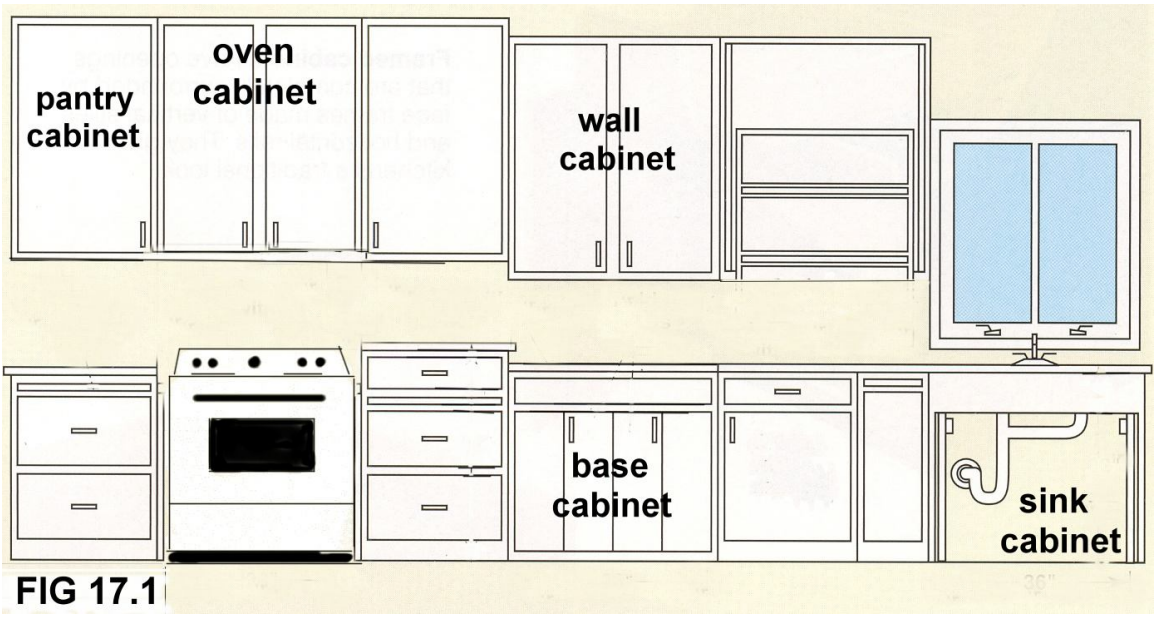


FIG 17.1

Base Cabinets (without countertop)	**Oven Cabinets**
Height 34 ½” Depth 24” Width 6” to 42” in 3” increments	Height 83”, 95 Depth 24” Width 30”, 33”
Wall Cabinets	**Pantry Cabinets**
Height 12”, 15”, 18”, 24”, 30”, 36” Depth 12” Width 6” to 36” in 3” increments	Height 83”, 95” Depth 24” Width 18”, 24”
Sink Cabinets	**Dishwasher Cabinets**
Depends on sink size	Height 34 ½” Depth 24” Width 24”

The base cabinets are the main cabinets and they are the ones that get the countertops. Some people like to have different heights and levels on the base cabinets, but the majority of us prefer to have all our base cabinets level throughout the kitchen. This includes islands and work centers like desks and bars.

Wall cabinets depend on the person’s height and preference. The cabinets where ovens and dishwashers fit into aren’t really cabinets at all. The oven just fits into a space made specifically for the oven and one that is equipped with the 240-volt oven/range wiring.

The dishwasher fits into a space that has a 120-volt outlet, a hot water line, and a wastewater outlet that goes to the septic system. Most people prefer to have a countertop over the dishwasher to keep everything continuous and level.

These measurements are very helpful in the early planning stages of a house. They help get everything into perspective.

Let's start with some simple and brief designs for building cabinet boxes. As we can see in **figure 17.2** and **17.3** there are many parts to a cabinet.

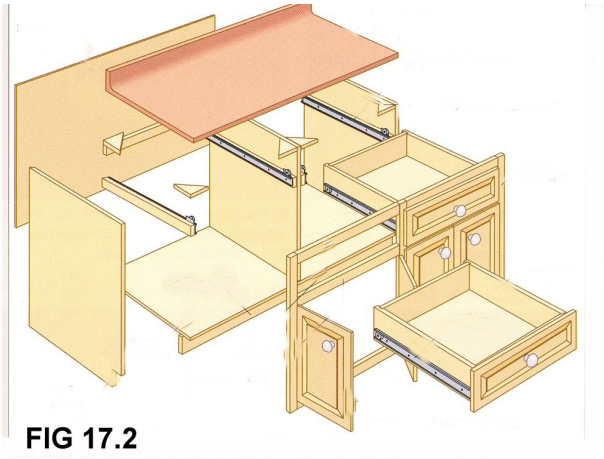


FIG 17.2

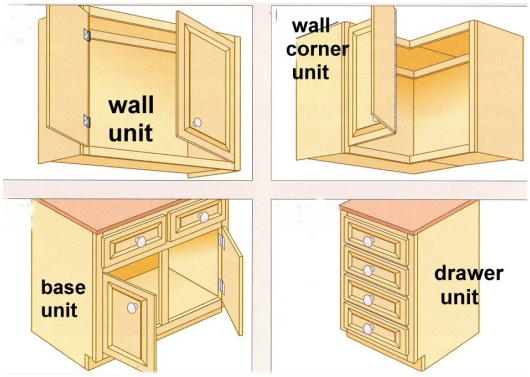


FIG 17.3

First we start with the box, which is sometimes called a carcass. You can build it out of whatever you want, but the better choice is a hardwood or a hardwood veneer. You will need to make it very strong with screws and glue. A good material for the inside of the carcass is called melamine. It is durable, smooth and comes in many colors including white so you can see things inside the cupboard easier. See **figure 17.4**. Some cabinet makers will use a wood veneer on the outside of the cabinets and melamine on the inside. It makes a very tough cabinet as it has two layers of wood. See **figure 17.5**.

FIG 17.4

FIG 17.5

Once the box is done you will need to sand it. See **figure 17.6.** After sanding it completely, you'll want to fill the holes and joints with putty. See **figure 17.7**. Let that dry overnight then sand it again. After that you should be able to apply the first coat of stain. See **figure 17.8**.

FIG 17.6

FIG 17.7

FIG 17.8

FIG 17.9

After you get the carcass stained you can stain the doors and let them dry so you can put them on with screws and hinges after the carcasses are hung. The doors should be made of solid wood. It's all right to use veneer on the carcasses, but the doors will have too much movement and the veneer will wear out.

Next we'll want to get all the measurements drawn out on the walls so we know exactly where to hang the cabinets. They are really heavy and the time for measuring for accuracy is before you're lifting them in place. It helps to have the screw holes already drilled before hanging the cabinets. Just drill a pilot hole all the way through that's about half the diameter of the screw so it goes in evenly while you're trying to hold the cabinet in place.

One very important thing that needs to be done before the sheetrock goes on is extra bracing for the kitchen cabinets. You can just add an extra layer of 2x6's crossways on the walls between the studs where the cabinets will be. This is overkill if professional cabinetmakers are doing the installing because they are good at finding the studs. I overbuilt my kitchen walls and my cabinet installer was grateful and quick. The cabinets are very secure.
Let's mark the walls where the wall cabinets will hang and where the base cabinets will be secured. You will also need to mark where the studs are. See **figure 17.10**.

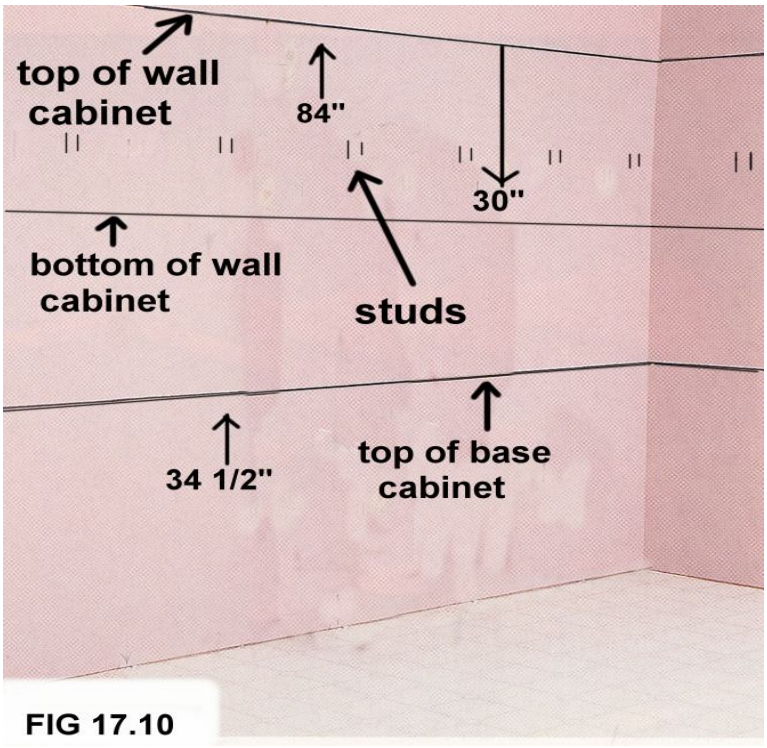


FIG 17.10

It makes the job easier if you mark a level line where the top of the wall cabinet will be. From there you can mark where the bottom of the wall cabinet will be. If you're short on help, you can put a 1X4 where the bottom of the wall cabinet will be and it will help support the weight of the cabinet until you get it completely fastened down. See **figure 17.11**.

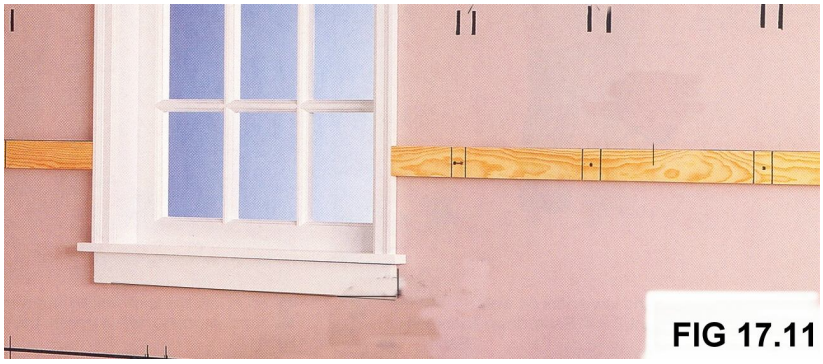


FIG 17.11

Let’s hang the first box as a starting point and everything else can butt up against it. We’ll let it rest against the board we’ve put up while we screw it in place.

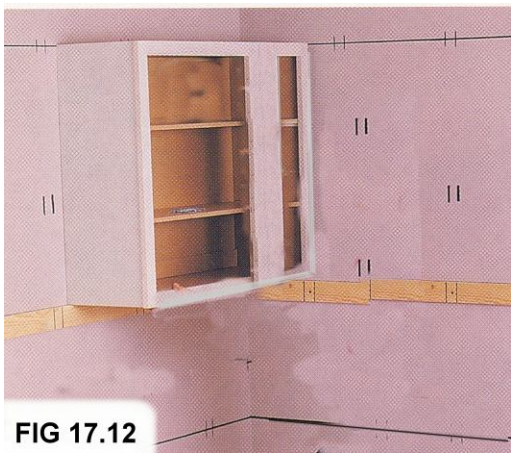


FIG 17.12

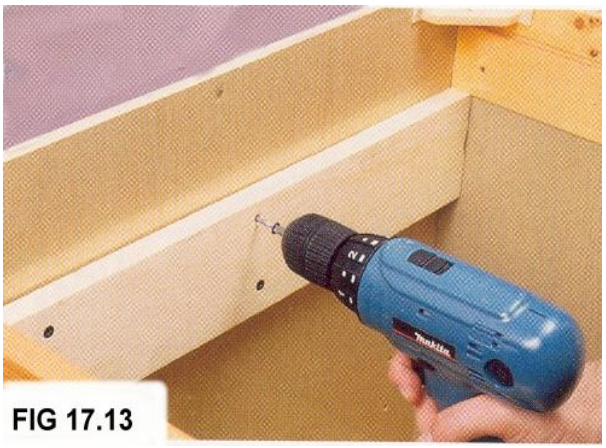


FIG 17.13

As shown in **figure 17.12**, the first wall cabinet is resting on the board or sometimes called a ledger to help hold it until all the screws are put in. It’s very important to get a good hold. The size of screws to use depends on the wall stud or joist it’s going into. Most cabinet installers use 3 or 4-inch screws. See **figure 17.13**.

The base cabinets are the same. It’s much easier to put the cabinets in without the countertop on. See **figure 17.14**.


FIG 17.14

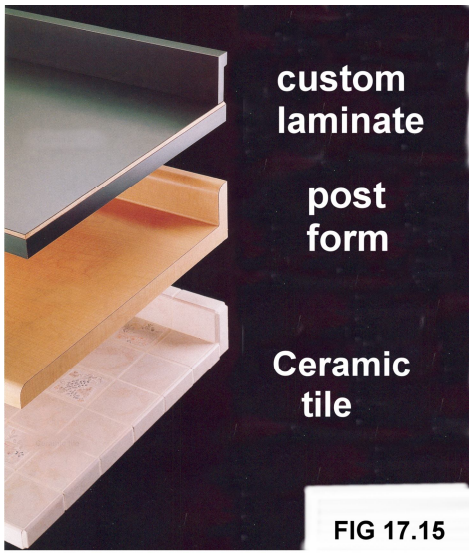


FIG 17.15

The countertops are fairly easy to install and they make everything beautiful. See **figure 17.15**. There are many choices and colors. You can try a custom laminate, which are sheet laminates of your choice of design and color glued to dense particleboard and fairly inexpensive too.

There's Post-form countertops that usually come from the factory with rounded faces and backs. They are also laminates glued to dense particleboard. You can buy these countertops pre-made or you can make them yourself. Tile countertops are becoming increasingly popular, but they are a little pricey and time-consuming.

Let's start with custom laminate. This is how it's made. You will need to get the particleboard countertop and measure it to the perfect fit. See **figure 17.16**.

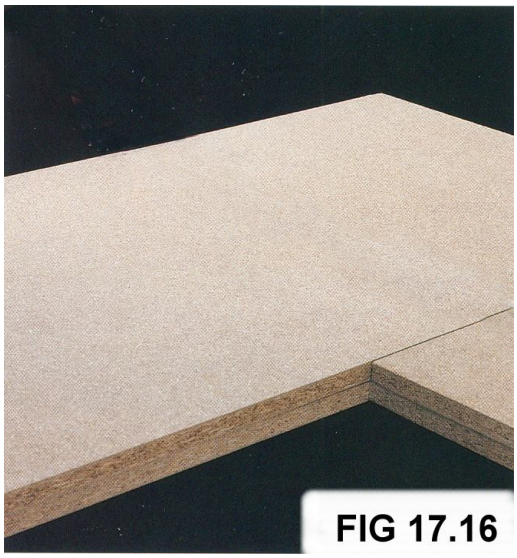


FIG 17.16


FIG 17.17

You will want to cut the sidepieces because they will go on first and try to leave extra to get routered off. See **figure 17.17**. The laminate is attached to the countertop with contact cement and pressed in place. See **figure 17.18**. Once it has had a short time to dry, you can router off the edges using a flush-cutting bit. See **figure 17.19**.

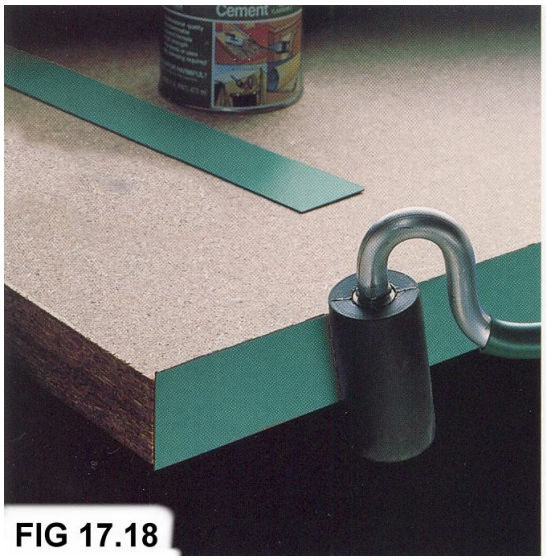


FIG 17.18


FIG 17.19

When you get the sides done you can do the top. Cut it with extra laminate to router off just like the sides. You will need to put contact cement on both the countertop and the laminate. The contact cement is not at all forgiving because it dries instantly so if you don't have someone to help you lay the laminate down on the counter, you can put spacers to position the laminate evenly over the countertop. Pull the spacers out as you go along pressing the laminate to the countertop. This also keeps bubbles out. See **figure 17.20**. The laminate should make a smooth, level surface when it's all done.

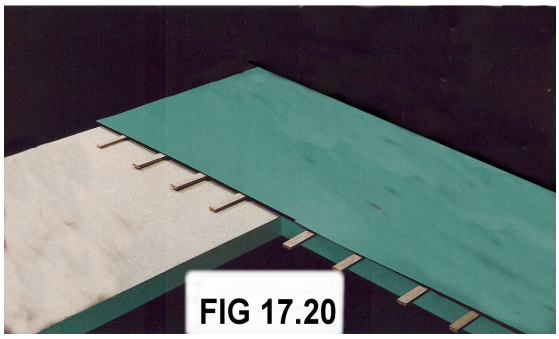


FIG 17.20

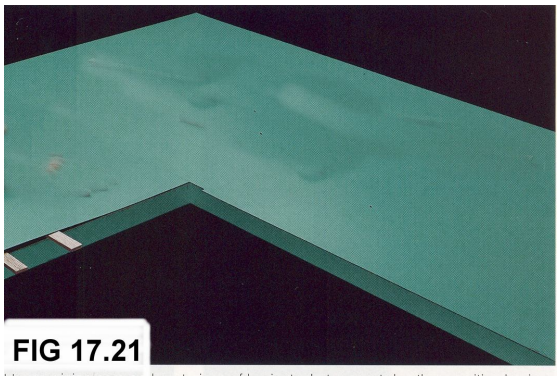


FIG 17.21

Now, let's talk about the post-form countertop where the laminate is already done.

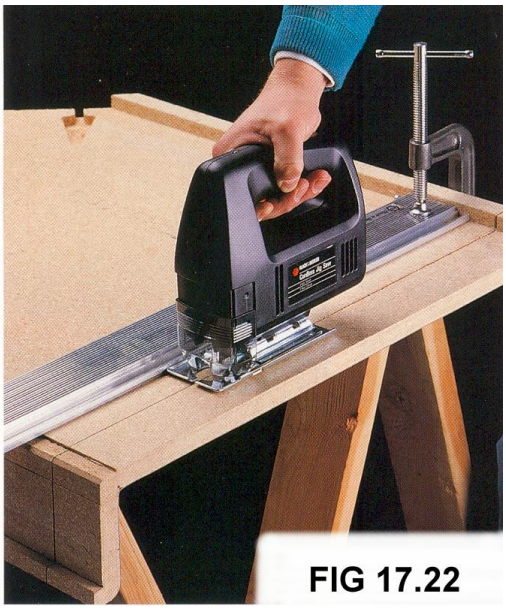


FIG 17.22

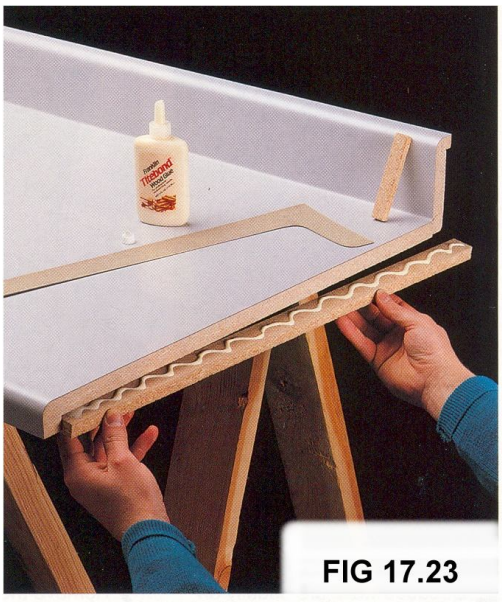


FIG 17.23

The post form countertops are already made so you just cut them to the right length and put a batten in the end. The batten helps make a more secure end plate. See **figures 17.22** and **17.23**.

FIG 17.24

FIG 17.25

When putting the end cap on you will need to activate the adhesive with an iron so it will make a good contact. See **figure 17.24**. Post form countertops are almost a guaranteed success. They make the job very easy.

We've already been over doing tile and tile countertops are exactly the same, but repetition doesn't hurt anything so we'll just do a brief run down on tile countertops.

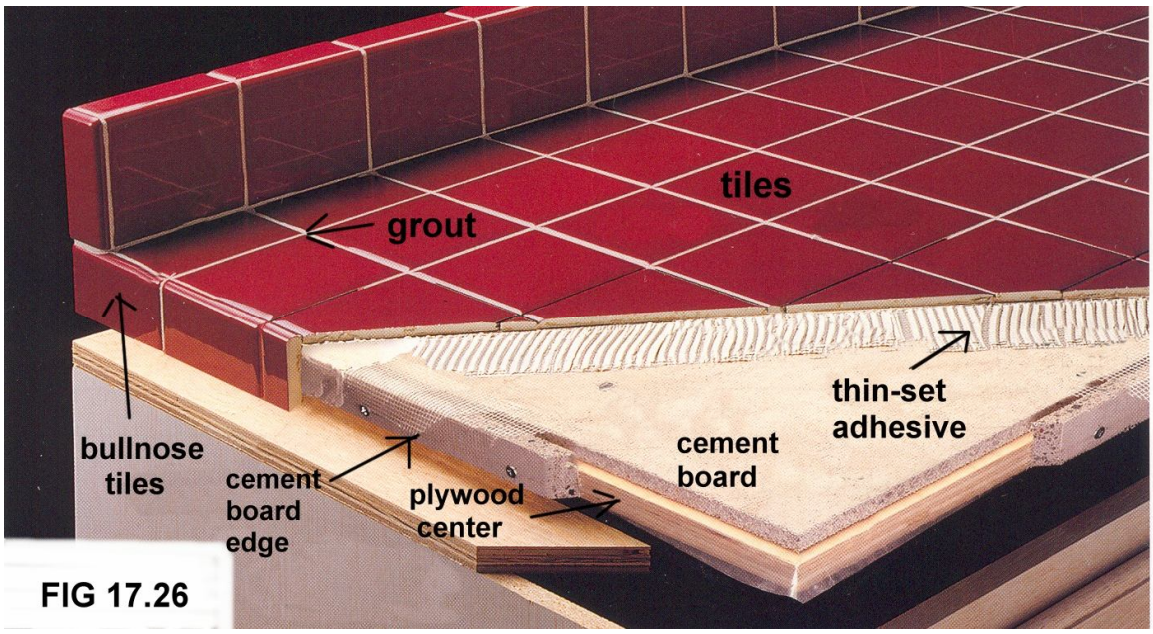


FIG 17.26

You start with the plywood center. You put a layer of plastic over the plywood. Then put the cement board on with screws. You will need to put cement board on the sides too.

Next put a layer of thin-set adhesive on the top in a small area and lay the tile in using spacers at the corners to get a uniform design. Next, do the sides with the special bull nose tiles. Once that has dried, you can start the grout. Take out the spacers and fill the cracks with grout. Get it into all of the cracks in a nice, even layer. Let it dry for a while, then go over it with a damp cloth to get the remainder of the grout off the tiles. Once it has dried, you can apply a grout sealant that will keep it from getting dirt into it.
That's it for cabinets; let's move on to other kitchen details. Before we move on to other things, check out my cabinets. They cost $6500; sometimes it's worth spending extra.

There are a few other important things to do with kitchens that are worth mentioning here. The kitchen sink is one of the items that is under planned. People that do a lot of cooking and food preparation should almost always have a triple sink. See **figure 17. 27**. While the triple sink isn't much more expensive than normal sinks, it takes up more space and needs to be planned out. Every bit of counter space in a kitchen is important.

FIG 17.27

For the person who doesn't have a passion for cooking a double sink is fine. I don't know any case where a single sink would be acceptable. Besides, a triple sink is one of those things appraisers and buyers remember as an "extra".
The cabinetmakers will usually cut the hole for the sink and some will even install it for you. If you have to install the sink, you will need to run a bead of silicone or plumbers putty around the flange of the sink and place it in the cut out. See **figure 17.28**. There are special fasteners that go under the sink to secure it with. See **figure 17.29**. You can really torque it down with these to make a good seal so the sink has a smooth edge.

FIG 17.28

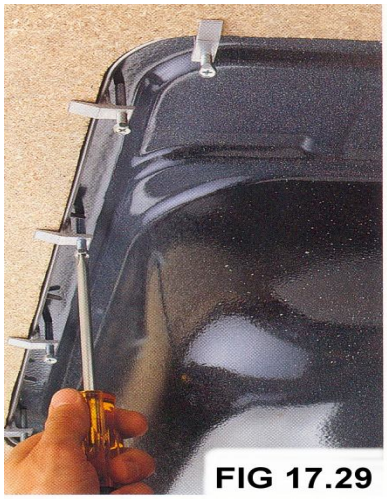


FIG 17.29

Once the sink is secured into the cutout we'll need to connect the wastewater line. A triple sink can get a little tricky. There are so many styles of triple sinks that it might be hard to find a PVC drain assembly to fit. It's not a bit difficult to make your own though. See **figure 17.30** and **17.31**.

FIG 17.30

FIG 17.31

This is how you might need to get creative when installing triple sinks. You will want to ask the plumbing inspector for suggestions, but as long as the p-trap is there and it's a 2-inch waste line, there most likely won't be any problems.

Let's get into the nitty-gritty of the drain installation. This is the same for any type of sink. First we need to put some plumbers putty around the underside flange of the strainer then put the strainer into the sink. This will keep the sink from leaking. Put the rubber washer in place and screw the locknut into place. See **figure 17.32**.

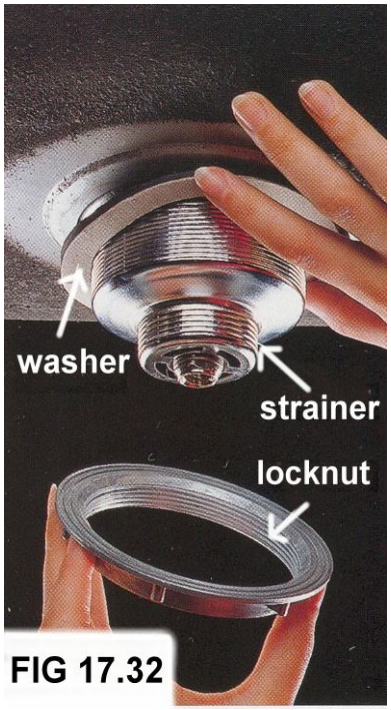


FIG 17.32

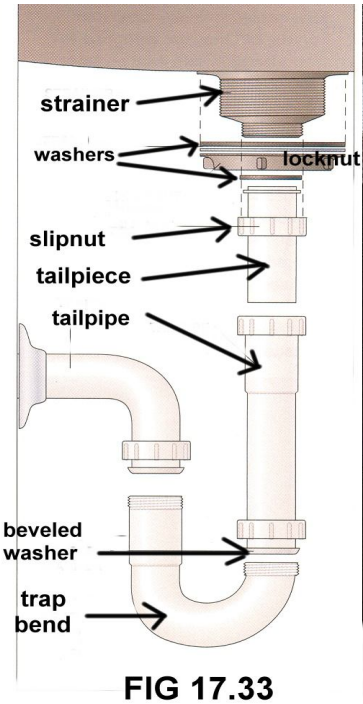


FIG 17.33

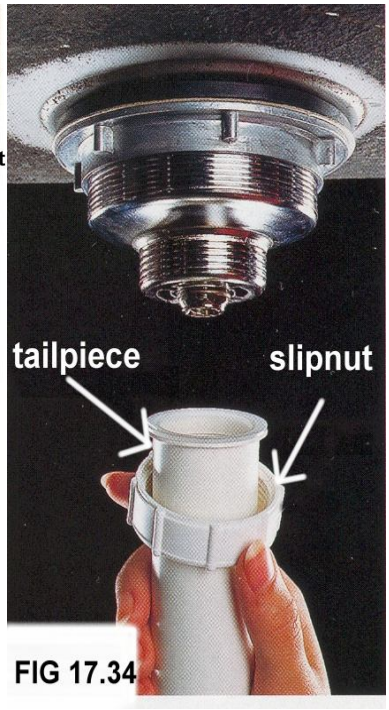


FIG 17.34

Next, put a washer on the rim of the tailpiece and put it on with the slipnut. See **figures 17.33** and **17.34**. The tailpiece usually needs to be cut off because it comes extra long. The tailpiece will then fit into the tailpipe and it can be adjusted to the height of the p-trap and then screwed on with the slipnut. **Figure 17.35** shows a double sink drain assembly. It just has another drain that goes into the main drain stack. The main stack goes to the p-trap and then out to the septic line.

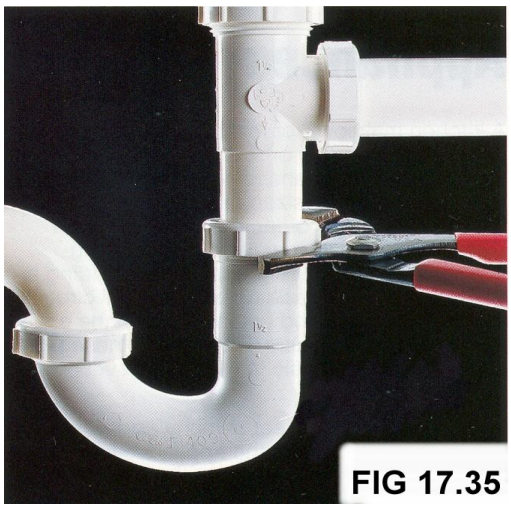


FIG 17.35

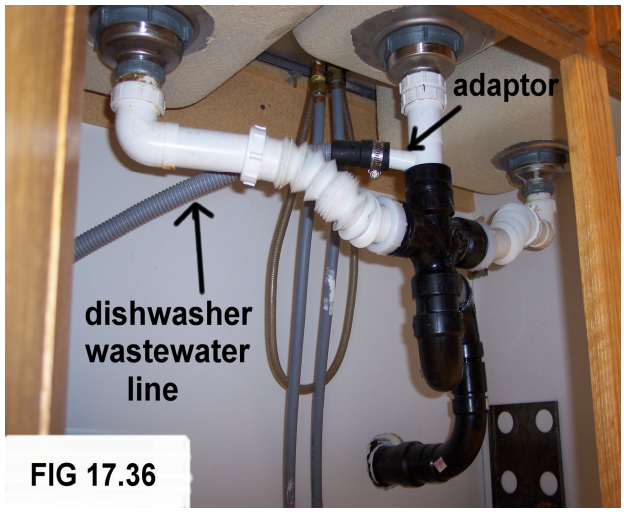


FIG 17.36

If you have a dishwasher you will need to have an outlet for the wastewater. A good place for that outlet is right on the tailpiece on the sink assembly. You can get tailpieces with dishwasher adaptors at any plumbing store. Almost everyone has a dishwasher these days. See **figure 17.36**

Now let's move on to the faucet installs and hot and cold water outlets. These are the same as all the other faucets and outlets. They just need to be screwed on. See **figure 17.37**

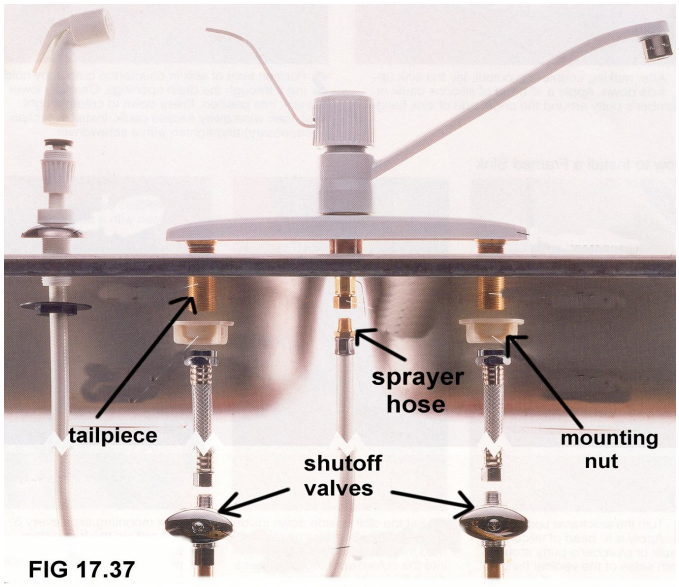


FIG 17.37

Now, let's learn how to install a dishwasher. We've already learned how to take the dishwasher wastewater outlet hose and connect it to the sink drainage assembly. Now we just need to hook up the hot water and the electricity. It's much easier if the dishwasher is close to the sink. If you're building your house new, then you will have a dishwasher line already run. If you're adding a dishwasher to a kitchen without that extra hot water line, you can simply put a T-fitting in the sink hot line as shown in **figure 17.38**. Connect it to the intake valve as shown in **figure 17.39**.

FIG 17.38

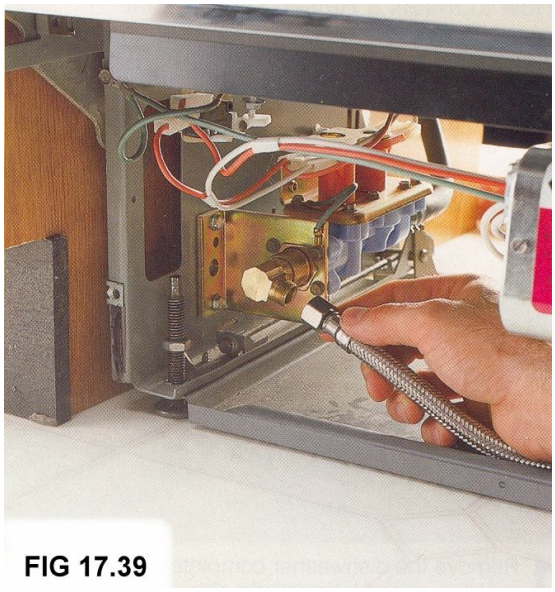


FIG 17.39

The dishwasher will need it's own dedicated 120-volt, 20-amp circuit, so it won't have an outlet or a plug. It is going to be hard-wired, but it's really easy. First, remember to shut the power off before doing any electrical work. You'll have to remove the panel on the dishwasher electric box. From there you just connect the black wire from the dishwasher to the black wire from the dedicated circuit run. Do the same with the white wire. Connect the green wire to the ground screw on the dishwasher. See **figure 17.40**.

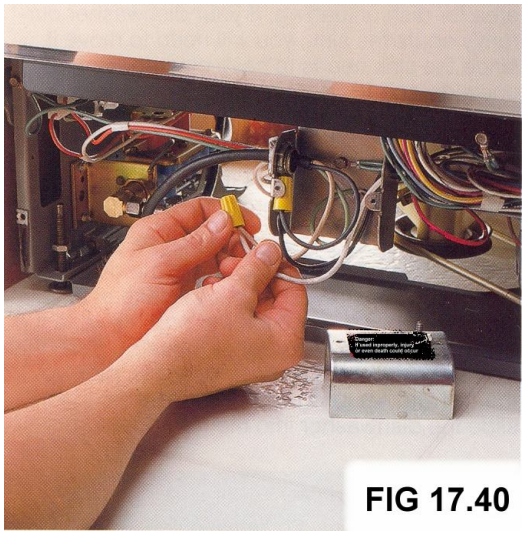


FIG 17.40

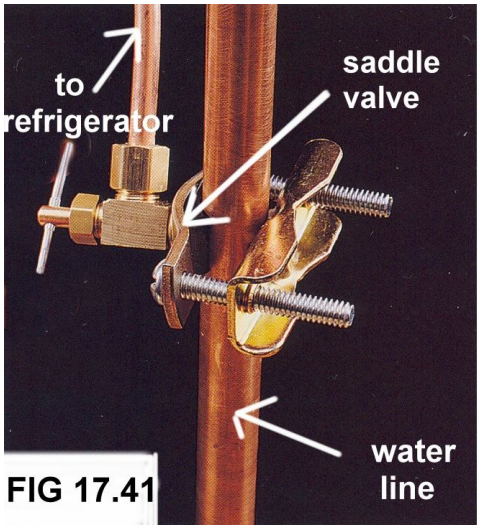


FIG 17.41

Now let's learn how to splice into a waterline to supply water to a refrigerator for the icemaker and water through the door. The modern refrigerators just have one line going to both the water through the door and the icemaker. It is done by putting a saddle valve onto an available cold water line. See **figure 17.41**. You puncture the waterline by turning the saddle valve until it breaks through. It makes a watertight seal and a new waterline at the same time. The other end just screws onto the refrigerator intake valve. You can use either copper tubing or plastic. They both work the same way.

Now let's move on to oven/range wiring. There are new code rules in some states that require a four-wire oven/range cable. So you will need to install a 4-wire outlet plug when you do the electrical. It's easy though. You just go look for range cable. It typically is called 6/3 cable. That just means it has 3 cables that are each 6 gauge and a bare copper ground wire. It makes 240-volts by adding together 2 of the 120-volt lines and using the third for a neutral wire that goes back to the neutral bus in the breaker box. A four-wire plug will just have the bare copper wire attached to the ground and it will be grounded to the oven chassis.

You will most likely have to attach the power cord to the oven at the junction box in back of the oven. You will have four wires. There will be a block with four screws on it and they will be marked. Two of the lines will be hot, one will be neutral and one will be a ground.

In **figure 17.42** we see the plug with four wires and in **figure 17.43** we see a block with four screws. Remember the red cable and the black cable are both hot lines. The white is a neutral and the ground will be connected to the oven ground.

FIG 17.42

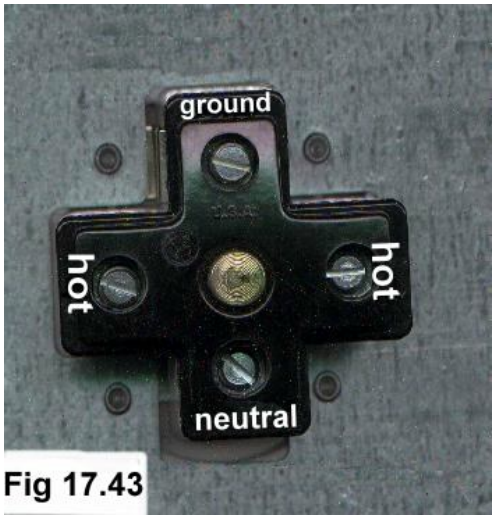


Fig 17.43

That pretty much covers it for the oven/range installation and it completes the section on kitchens and cabinets.

EIGHTEEN

FINISH WORK

I think the funnest part of the whole building process is doing the finish work, although people have said to me, “I just want to get it over and done”. I like it and it’s easy to get fired up to put the finishing touches on things before you move in.

In most cases if the house is financed, the leinholders or banks won’t let you move in until you get the occupancy permit, which is actually a good thing. I know some families who moved in to their unfinished houses and they had a difficult time getting motivated to finish.

The occupancy permit varies from state to state, but it is basically the green light to move in from the local inspectors stating that the house is completely finished and safe.

Now, we still have a few things left to do to finish our house. The walls may or may not be painted. It’s easier to paint the walls before the carpet goes in. The stairs need railings, and the baseboards need to be put on. All the lights and cover plates still have to be put on. Windows need to be finished. Trim has to be put up and we’d like to put a deck and a sidewalk in.

I don’t have a clue what I’m doing when I’m painting. I really don’t like to paint so giving advice how to paint would be poor advice. When it came time to do all the painting, my wife and sister-in-law stepped up. They really enjoy painting and they had the whole interior primed in one day, then they came back the next day and painted everything. It looked perfect and they never made a mess at all like I always do.

I won’t go into how to paint because anyone can do it better than me, so I will move on to other things that I’m better at.

Let’s talk about stair and handrail assembly. That’s cool stuff. The stair rail needs to be made very solid and stable. It should be made out of hard wood. It’s important to make it look nice while at the same time making it really durable. That can be challenging.

The cutaway drawing in **figure 18.1** shows how the stair pieces all fit together. This is a stairway with a landing, which is very popular right now. The drawing shows the newel post attached to the stringers in the stairway. This makes for a good stable fit.

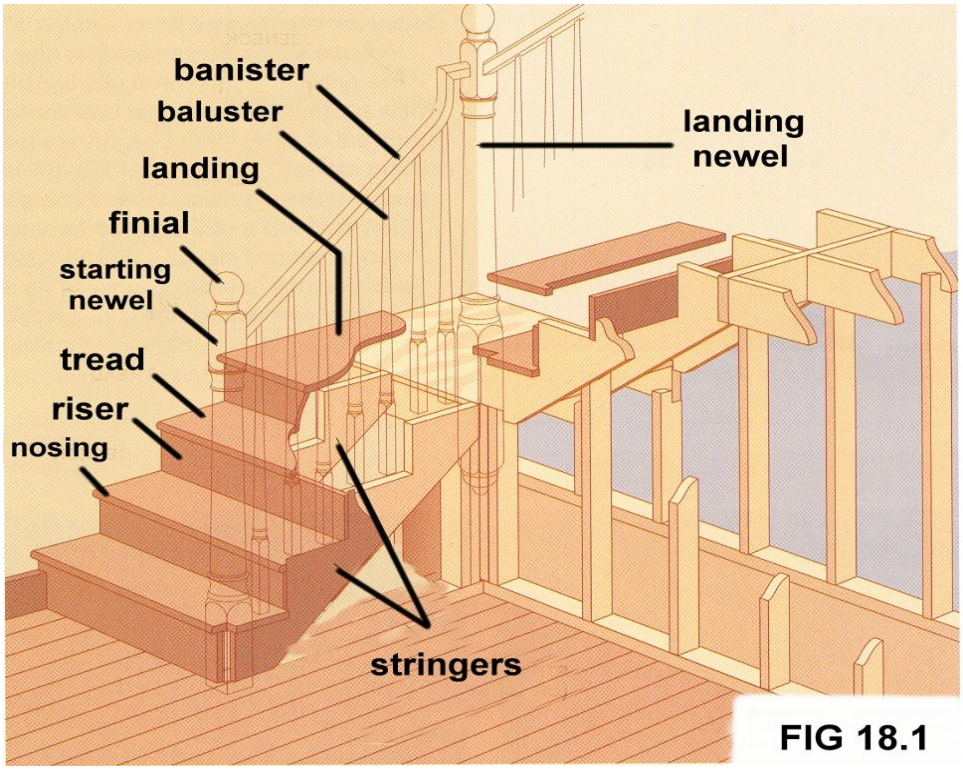


FIG 18.1

The landing newel will be a really strong support for the rest of the stair railing. It will need to be braced very well. Figure 18.2 shows us how to connect the newel post to the handrail. You will need to drill a hole big enough to get a wooden plug into. A spade bit works best for that. Figure 18.3 shows how to secure the stair treads if you need to.

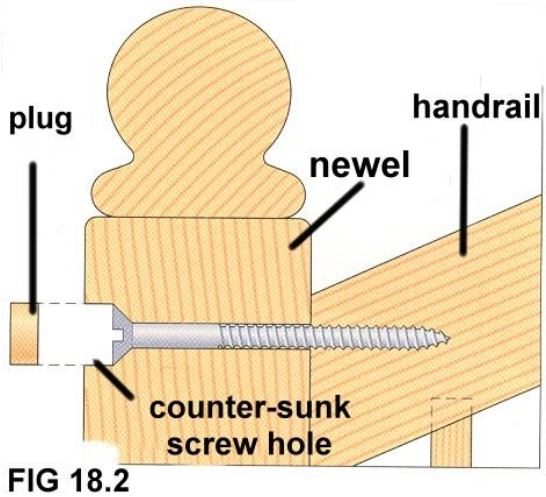


FIG 18.2

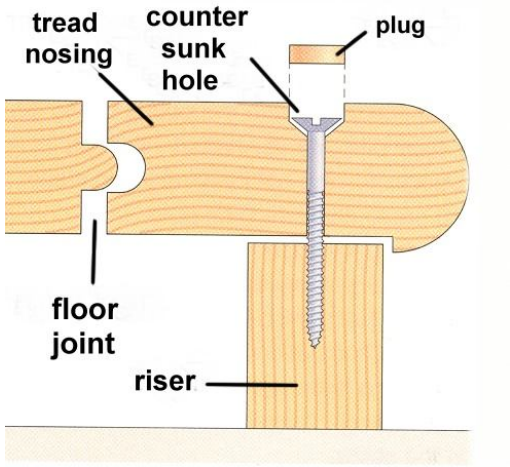


FIG 18.3

I made my stairs and rails extra strong by putting in newel posts very securely, and then attaching the handrail with 4-inch lag screws. I also attached each baluster with screws and glue and then reinforced each connection with oak plates on each side of the baluster. It's overkill, but as a kid I would always do Tarzan swings off the stairs and my kids will probably do the same. **Figure 18.4** is my own stairs. They have held up extremely well.

FIG 18.4

As you can see in **figure 18.5** I was able to secure the balusters with small plates of oak after screwing them in. This takes the pressure off the screws. Try to use wood glue on every connection because it really helps a lot. After the balusters are connected and screwed in place you will need to cover in the holes with a similar color of wood putty. For the bigger holes where the lag screws are, it looks quite good to get plugs that are made of the same kind of wood of coarse. See **figure 18.6** After all these are secure, you can sand any of the rough spots, and then stain the oak with two layers of Varathane.

FIG 18.5

FIG 18.6

You can find all the different types of stair assemblies at your hardware stores. All you have to do is take your measurements and they can get you all the parts you need.

Let's move on to trim pieces. You can use baseboards or trim pieces to line your doors, windows, floors or ceilings. Real wood is in very high demand and it almost always raises the value of your house much higher than it would be without wood trim. See **figures 18.7** and **18.8**.

If you can get a good deal on hardwood boards then definitely go for it. Oak is particularly beautiful and you can find many shades of stain. It's worth the extra money spent. I lined my entryways with oak, but used painted finger-joint pine trim for my doorways and windows. I wished I would have gone with oak throughout, but it's a big difference in price at a time when money is tight.

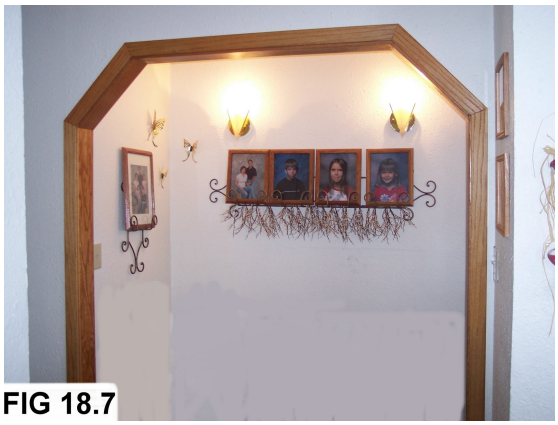


FIG 18.7

FIG 18.8

There are many different kinds of trim styles and colors to choose from. If you're really on a budget, you can get the finger joint pine and paint it. That actually looks pretty good. You can also buy some pre-painted trim and save some time by not having to paint it.

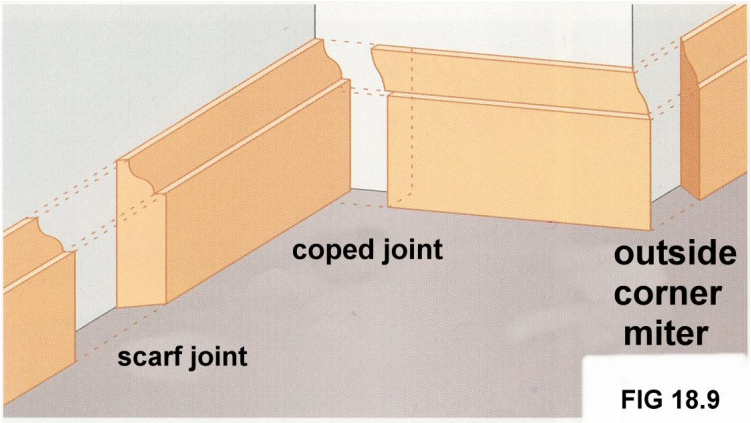


FIG 18.9

This is how the trim pieces are cut to fit together. There is the scarf joint that joins

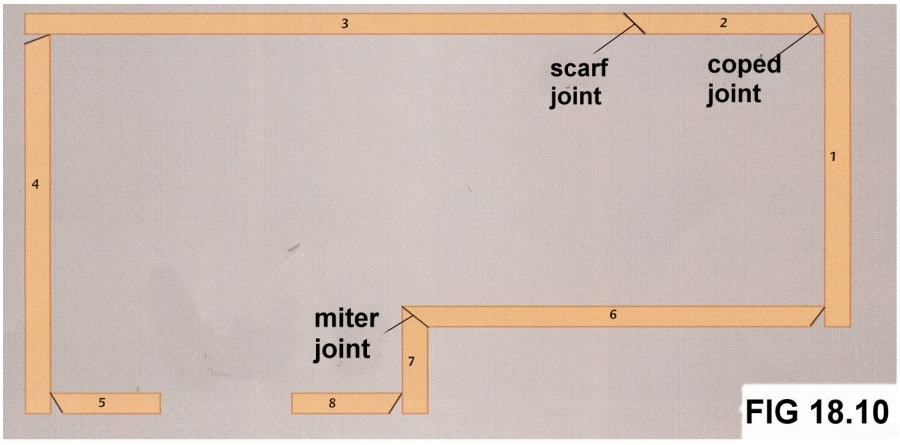


FIG 18.10

trim pieces in a line. There's the coped joint that's used for inside corners, and there's the outside miter joint for outside corners. This is the simplest way to do baseboards.

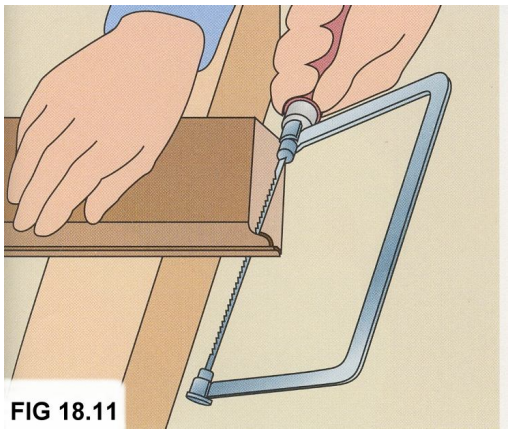


FIG 18.11

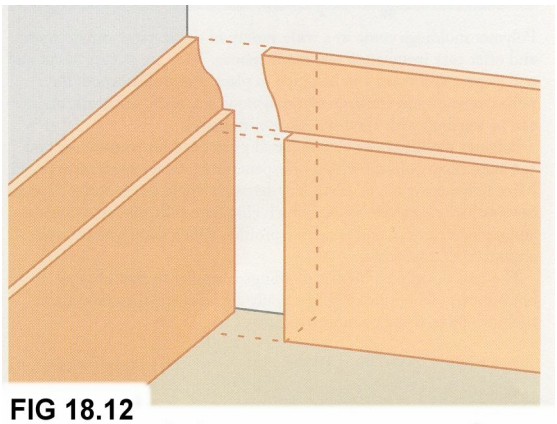


FIG 18.12

The coped joint is a little tricky. You need to cut the end of the molding at a 45-degree angle with the backside longer than the front side. Take a coping saw and cut along the contour as in **figure 18.11**. Once that's done, bring the two pieces together to see how they fit as shown in **figure 18.12**. If the joints don't match up very well, you can make adjustments with a utility knife or some sand paper. If you're planning on painting the baseboards, you can dab a little silicone in the joints or cracks.

The easiest way to cut trim pieces is with a miter saw, but not everyone can afford one, so a three dollar miter box, either plastic or wood and a five dollar back saw work just as well. Trim pieces for doors and windows are pretty much 45 degree angles. That makes it really easy to get a lot of work done in a short time.

In my house, I made the trim work a little more challenging and put in several small arches that give it personality. See **figures 18.13** and **18.14**.

FIG 18.13

If some of the trim measurements aren't 45-degrees, then you can still find the angles. Sometimes it's just a matter of holding the two pieces together and marking them where you think the angle should be and then making adjustments to it. Common sense will be your biggest asset when you're building your house. If you don't have much common sense when you start, you'll have tons of it when you finish.

The door trims are the easiest. You just need to measure to the top of your door, add the width of the trim and you will have the length of the vertical trim pieces. Cut them at 45-degree angles and then put them in place. Then you just take a measurement across the doorway including the trim on the sides and you have the horizontal trim measurement. Just cut that at 45-degree angles on each side and you are done. See **figure 18.14**.

FIG 18.14

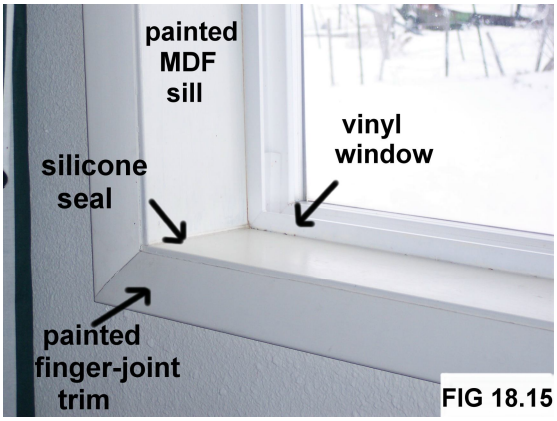


FIG 18.15

The windows will need something to cover up the rough work. This is one of the few areas that didn't get covered up with sheetrock. We need to make a frame on the inside all around the window seal. One of the most popular materials used for windowsill framing is called MDF or Medium Density Fiberboard. It's actually really tough stuff. You can put it in without any fancy cuts and it will look just fine. It usually gets silicone in the seams so you can just paint over the silicone and make a great seal against moisture. If you want to miter the ends into 45-degree angles, it will probably fit better, but either way is fine. See **figure 18.15**.

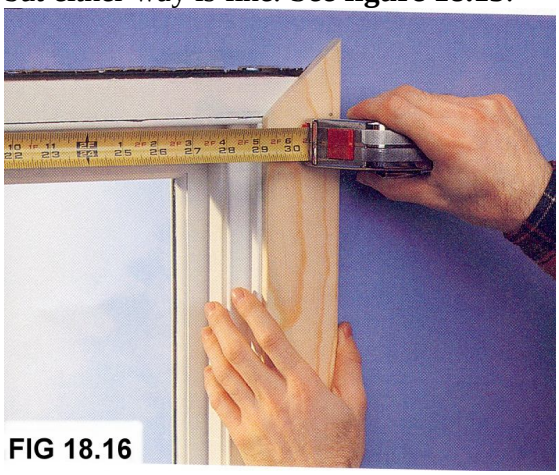


FIG 18.16


FIG 18.17

The window trim is almost as easy as the door trim except you have four sides and they all need to match up so you don't have big cracks between the trim pieces. Silicone can only do so much. **Figures 18.16** and **18.17** show how to attach the window trim for perfect 45-degree angles. **Figure 18.18** shows a slightly more complex angle, but still very easy to figure out. The octagon window has been such a big hit with my children.

FIG 18.18

That's really all the information we need to do all the trim and baseboard stuff. Now let's move on to some of the lighting. Up to this point, we should be completely done with the sheetrock and any texturing. The lights in the ceilings can now be put in. There are the specialty lights that take a little TLC like the fan/light in **figure 18.19**.

FIG 18.19

Fans like these are heavy and they need to have a special reinforced box that attaches between joists or rafters. We covered that back in chapter 9. The constant movement of the fan will also work weak connections loose over the years so make sure it is strong. There are basically two types of modern light box connections. The larger, heavier lights usually require a strap connection with mounting screws as shown in **figure 18.20**, but lighter fixtures can get by with just a nipple mount as shown in **figure 18.21**.

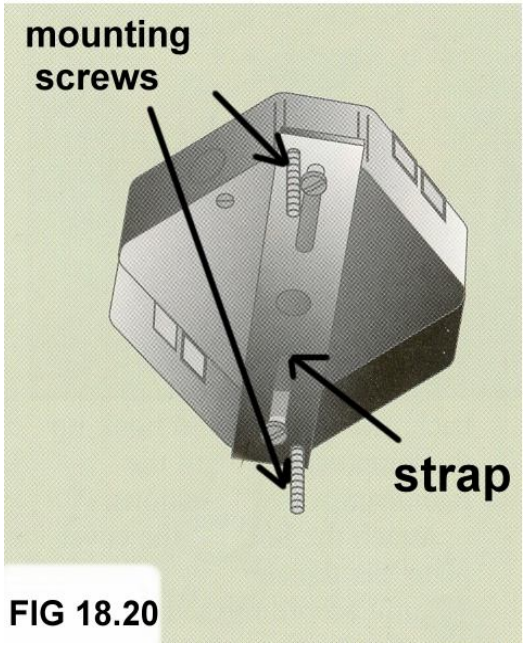


FIG 18.20

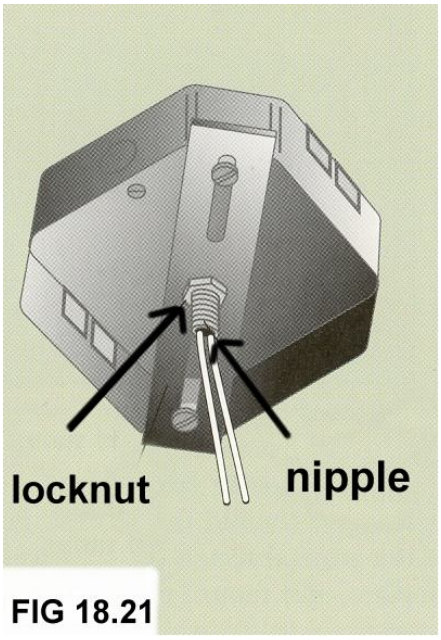


FIG 18.21

Fans and heavy fixtures will require a connection that uses mounting screws, but small lights as shown in **figure 18.22** and **18.23** only need a nipple mount and are really quick to install.


FIG 18.22


FIG 18.23

The lights that will be the most difficult are the fluorescent lights, but even they aren't any problem. Sometimes it helps to have two people on the bigger lights.

Fluorescent lights will last longer than incandescent lights, but after a few years, fluorescent lights can have trouble with weakening ballasts. You can tell by the slow response time that it illuminates after turning it on. They are still an excellent option especially where extra lighting is needed. Kitchens are usually the most popular place for larger fluorescent lights. Most larger fluorescent lights will need some assembly. You will probably need to slide the lamp holders in place. The electrical connection is the same as everything else; white-to-white, black-to-black. You will probably need to put a cover plate over the ballast and then put the fluorescent tubes in. The cover will go on and that's it. Some of the bigger lights will have multiple ballasts, but it's still really easy to figure out. See **figure 18.24**.

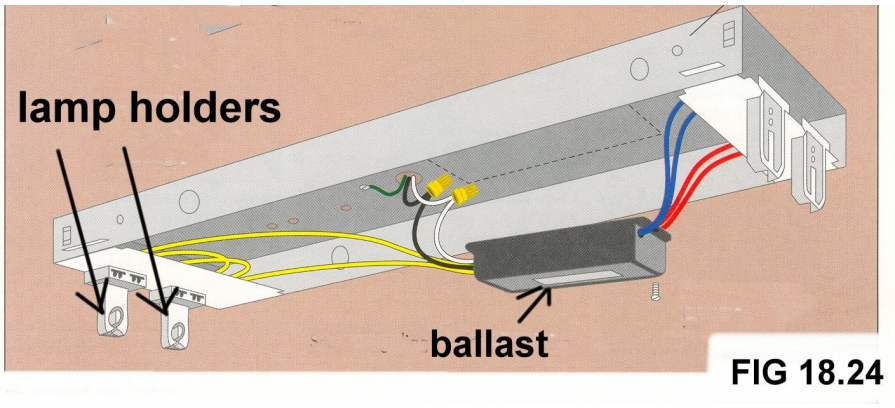


FIG 18.24

Next, we'll move on to the cover plates for light switches and outlets. This couldn't be any easier than it is. You just put the right plate on the right switches and screw them down. See **figures 18.25** and **18.26**.


FIG 18.25

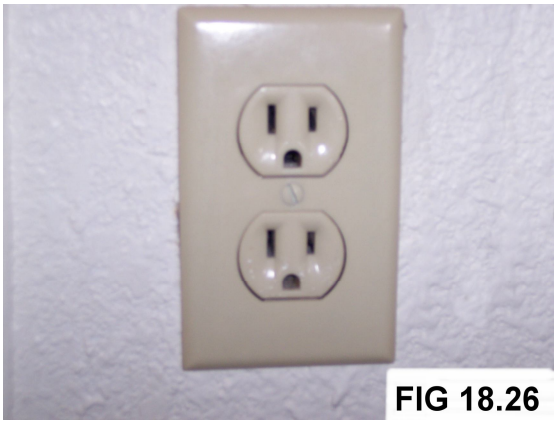


FIG 18.26

Well, that's it for the finish work. The inside of the house should be ready and all the fixtures should be fully functional. It's at this point where the occupancy permit is issued. The decks and sidewalks aren't considered part of the physical house, so even though they aren't finished, the house is still considered to be finished.

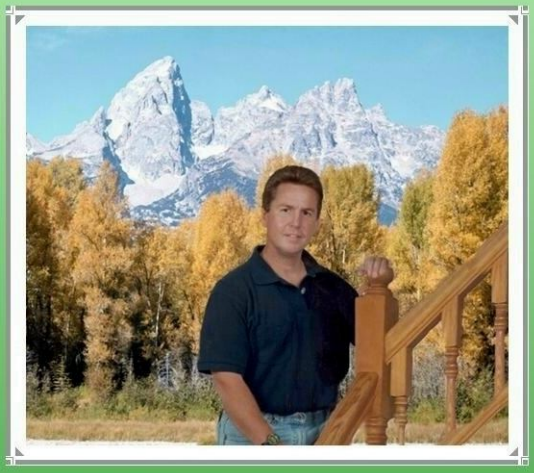
That is all there is to building your own house. The short-term hard work might seem as if it will last forever, but it gets over soon enough. What will last forever are all the benefits. The financial, the pride, the emotional, all these and many more benefits will stick with you forever. Nobody can take them away. They are your reward for the small sacrifice of time, sweat, and money you gave for a short time. I hope this book has helped you make a decision to build your own house. You'll be so glad you did.

End

Larry Angell

"I was able to save over $240,000
in interest over 30 years
by doing my own labor."

"The world beats us down every day...



But we don't have to stay down."

Sweat Equity is a house building reference guide for people with no previous carpentry experience. A century ago, it was normal for people to build their own houses. Only the rich could afford a carpenter built home. With the discovery of Electricity, many rules have been made to protect us from our own ignorance and so most of us feel inadequate to build a home.

Larry Angell has removed many of the mysteries of house building in a step-by-step, easy to understand book. It also reveals many of the benefits that owner/builders have in terms of equity. Sweat from house labor has a value and Larry is able to put a price on it.

Angell press