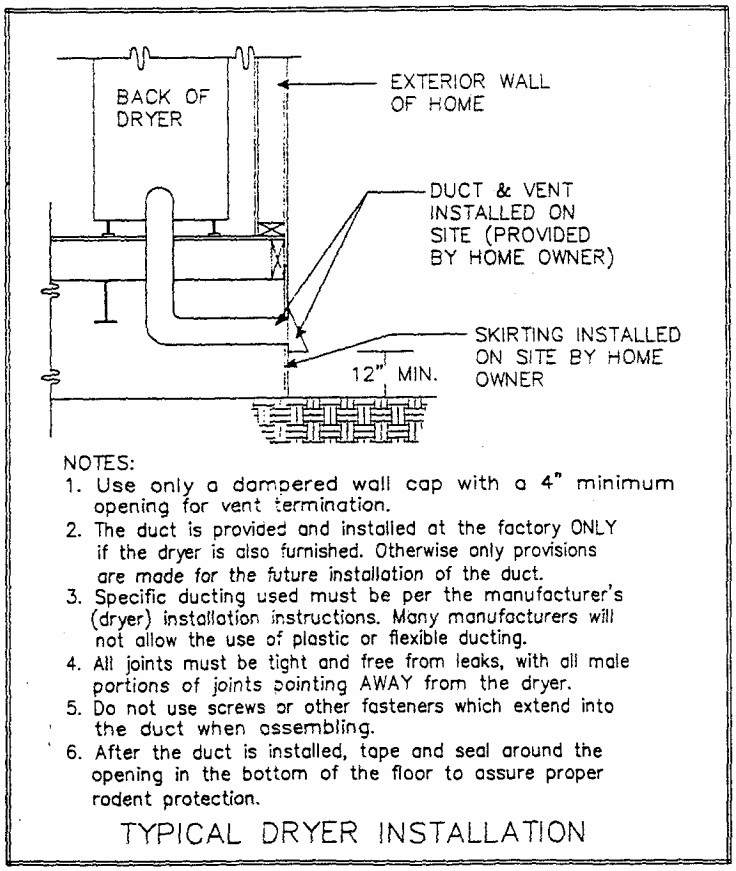
UTILITIES ASSEMBLY

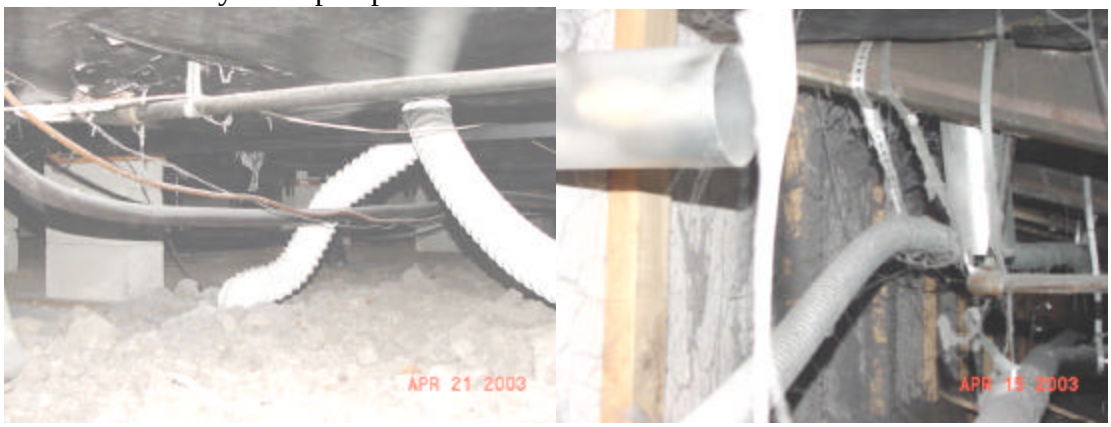
A dryer vent must be properly installed and stubbed out of the home with a vent cap capable of keeping rodents out. The pipe should be smooth wall pipe such as this aluminum pipe sealed with aluminum tape. Do not use flexible plastic. Do not use screws to fasten sections or fittings, instead, use a listed aluminum tape. Lint fires are possible and an approved vent installation is important. The outlet should be 12" off the ground.



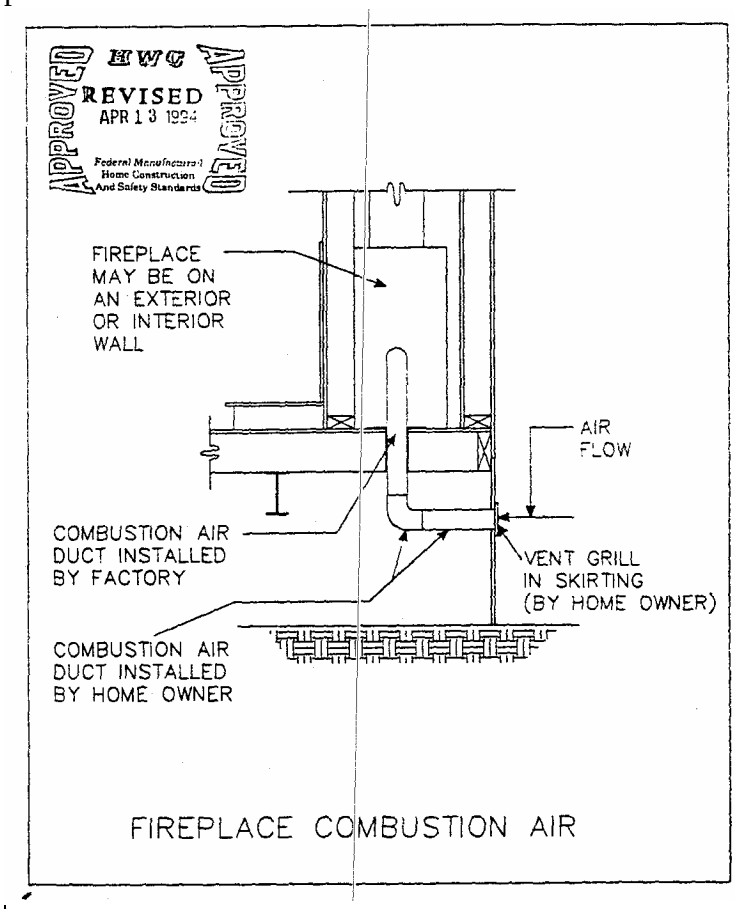
NOTES:
1. Use only a dampered wall cap with a 4" minimum opening for vent termination.
2. The duct is provided and installed at the factory ONLY if the dryer is also furnished. Otherwise only provisions are made for the future installation of the duct.
3. Specific ducting used must be per the manufacturer's (dryer) installation instructions. Many manufacturers will not allow the use of plastic or flexible ducting.
4. All joints must be tight and free from leaks, with all male portions of joints pointing AWAY from the dryer.
5. Do not use screws or other fasteners which extend into the duct when assembling.
6. After the duct is installed, tape and seal around the opening in the bottom of the floor to assure proper rodent protection.

TYPICAL DRYER INSTALLATION

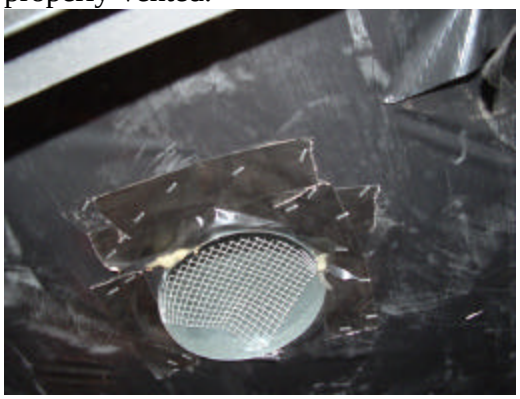
Failing to professionally install a proper dryer duct may lead to fire hazard and humidity damage to the home. This plastic duct came loose from the outlet and has allowed high levels of humidity to be pumped under the home for some time.



If a fireplace is provided, you must install a screened intake combustion air inlet pipe per plan.



The fireplace intake was not piped out for proper installation. Chances are it will get plenty of air. As it draws air, adequate amounts of fresh air can enter the siding vents if properly vented.



Water

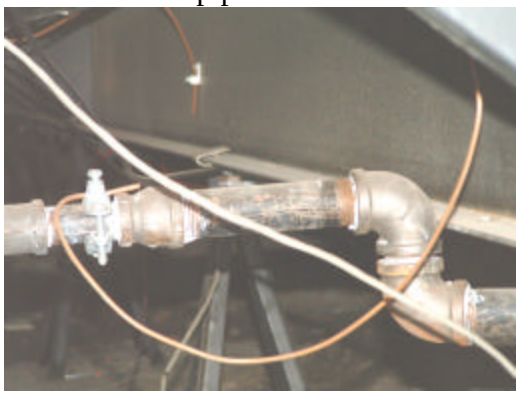
Most multi section homes will have utility connections between them. Some enforcement agencies require crossover connections that are flexible or can be disconnected. Others allow solid connections. Water crossovers are often difficult and leak prone when using factory provided union couplers. I often cut these off and connect the sections with solid pipe and couplers. It can be helpful to use elbows to come down from the floor cavity, across the matting line and back up. When placing homes in locations known to freeze, the crossovers must be insulated.

Water pipes should stub out 4” to 6” from the home and against the rim joist or high enough to connect to the supply. Check for loose fittings and shut off valves at the dishwasher plumbing, Ice maker supply, washing machine supply, kitchen sink supply, bathroom sinks and toilets, bathtubs, shower fixtures and water heater. If connecting to a park supply, a ¾” water hater copper flex is a good chose for a flexible connector. Another option is soft 5/8” or ¾” copper tubing with flare or compression fittings. Remove blocks between the toilet float arms and fill valves and allow the toilet to fill.

Adjust the toilet tank fill valves to the indicated line in the tank, ensuring they do not overflow or run.

Water pipes should stub out 4” to 6” from the home and against the rim joist or high enough to connect to the supply. If connecting to a park supply, a ¾” water hater copper flex is a good chose for a flexible connector. Another option is soft 5/8” or ¾” copper tubing with flare or compression fittings. The flare fittings are more prone to failure. Remove blocks between the toilet float arms and fill valves and allow the toilet to fill.

Metallic water pipes must be bonded to the home chassis.



This factory installed water filter had loose fittings and leaked profusely.

Gas

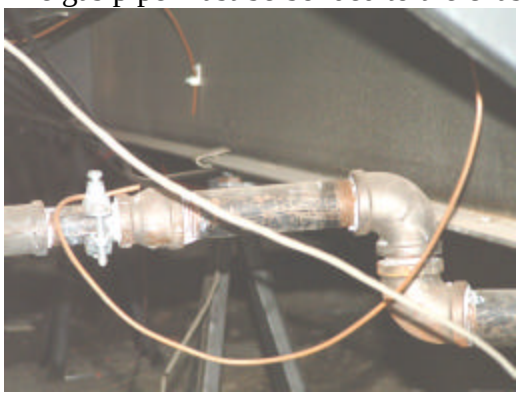
Gas crossovers are generally done with reliable factory provided quick release couplers and flex pipes. I have on a few occasions found the connections loose or damaged so I check them and soap test them later, while performing a gas pressure test.

This cross over flex was found damaged and had to be replaced.

Gas pipe can be extended under the home and stubbed out in a proper location. There are rules that dictate the distance from the gas pipe or gas meter vent and windows, vents, electrical boxes and other. Check with the enforcement agency or gas supplier if you are not sure. I stay 30” away horizontally from electric panels and window openings. Foundation vents call for 12” horizontally from the gas meter vent. Gas pipes should stub out 4” to 6” out from the home. I like to fasten the pipe to the rim joist and it should have a solid brace at its point of termination.
For soft set applications, expect to use a properly sized gas flex pipe such as 1 1/8” gas flex, which should start outside the home and continue to the gas supply. Be sure a proper gas shut off valve is provided at the riser or gas supply. Gas appliances are generally installed ready for natural gas, and must be converted professionally for use with propane gas. Converting appliances is technical and should be left to a gas appliance expert. I have converted many appliances over the years but sleep much better now that I defer the work to a gas provider with expertise and insurance for this work.

Note the gas pipe is not extended through the skirting and the gas flex is contained under the home. The gas flex can be damaged by rubbing on the skirting and can be a hazard if the flex is ruptured during an earthquake or if the home is pushed over during extreme winds.

The gas pipe must be bonded to the chassis



The gas pipe should be solidly attached to the home or framing where it stubs out.

A gas meter must be properly supported. The park should provide the support, but if not, the installer should provide it.

ELECTRIC

Electrical crossovers vary in style but all the installation manuals have drawing and instructions on how to properly connect them. Some units are connected inside the walls before joining the sections. Most connect under the home after the units are joined. Some use metal flexible conduit, strain relief and Junction boxes to make connections while others use snap together connectors. Some have one and others have many crossovers. Regardless of the type, follow the instructions provided in the installation manual. Crossovers without protective conduit must not be left hanging loose under the home. Snap together connectors must be fastened to the structure as depicted in the installation instructions. Romex crossover wire running through joist notches must be protected with nail plates as depicted in the installation instructions. Manufacturers should clearly mark locations and label crossovers to simplify locating and correct connections. If the crossovers do not match up in size, numbering, location or are missing, defer the issue to factory service. The installer's job is to install and connect, not build or re build. Some crossovers are well hidden and must be searched out. Often the search starts after the home is energized and a circuit does not work.

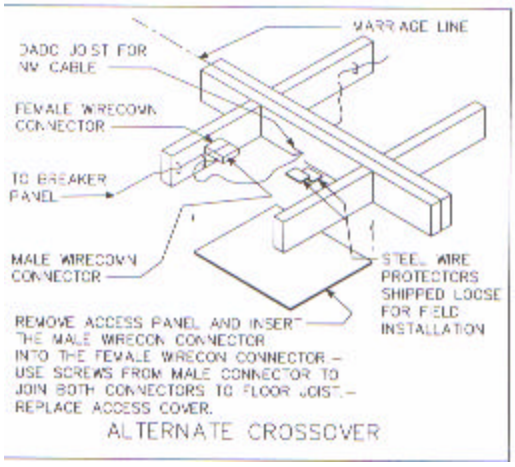
Before the home is energized, the following must be performed:

- Ensure all sections are bonded or grounded together at the chassis.
- Ensure the gas pipe is grounded to the chassis
- Install grounding from the chassis to any metallic water supply pipe.
- Ensure the home sub panel is grounded. In soft set applications this is usually accomplished with metallic flex conduit from the supply meter panel. On permanent foundation installations, it is usually done with a permanent foundation UFFR ground conductor or a ground rod and proper connection.
- Bonding sizes are usually #8 copper for pipes, #6 copper for chassis to chassis, #4 copper for UFFR to panel or service to panel up to 200 amps.

Remove covers at fan boxes and ensure the conductors are protected with wire nuts tightly attached.

This electric crossover is unsafe. It should be sealed into the floor system, protected with nail plates at the joist notches and the connectors fastened to plan to the joists.

This is how the crossovers above should be installed.



This electric crossover was installed on site without the required romex protector strain relief. Strain reliefs can be purchased at nearly all hardware stores.

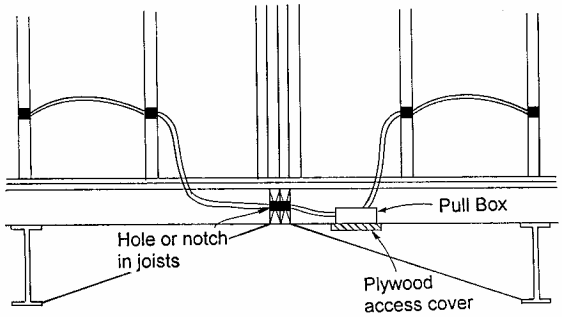


FIG. 5-28A

This set of crossovers has two more circuits on one side. If the missing circuits cannot be located, it should be deferred to the factory for service.

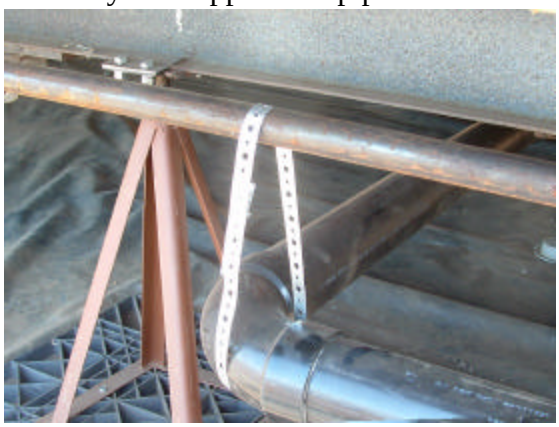
Sewer

Sewer can be as simple as a single drop from one floor section or a complete system that has to be fit and assembled on site. If the system is pre built and cut in sections for site installation, check the layout and see if it is going the right direction. Too often the home is built with utility outlets in either wrong or standard locations that do not work for your application. If the sewer must be relocated, it may require a permit to modify it. If it will work as designed, first dry fit the sections, then strap up at 4' intervals, ensure 2% slope or 1% with approved clean outs. 2% slope is ¼" per foot or 1" in 4'. I use a tape measure to set the straps an inch lower every strap (4') or ½" per strap for 1% slope. A rubber coupler can be used at the matting line if a flexible connector is required. Once the system is proven to fit, drain and work, go back and disassemble each fitting, clean and glue with approved ABS glue. Work one section at a time, ream any sharp edges or cut tailings inside and out of cut pipes; failing to do so may cause sewer back ups or failed glue joints where glue is scraped out during installation. Allow proper cure time for the fittings. Rushing the glue work may ensure a failed glue bond at a critical fitting. When

finished assembling, go back with a flashlight and check each fitting for glue since it is easy to miss one. Adjust support straps for proper slope. While the home is built to a HUD code and metal straps to ABS pipe is an accepted practice with manufactured homes, I have had a few building inspectors require me to use plastic straps or duct tape to protect the pipe from chaffing, which comes from a UPC code. Arguing with an inspector is often useless. It is probably easier to comply than force the issue.
Where the drain pipe exits the home on a soft set, it is usually above grade and connected to a park drain inlet with a rubber coupler. If a permanent foundation system is used, usually, the pipe should exit the home at 12" below grade and have a two way clean out within 2' of the home.
A few common sense rules for drain pipe:

- Try to always use a long sweep elbow when possible.
- Use a Combo fitting to connect two pipes in a T intersection.
- Do not use a Sanitary T on its side. It can be used for a lot inlet with a clean out cap when installed in the vertical plane.
- Use full size clean outs, do not choke down the clean out size.
- 2% slope is the preferred sewer slope, which equals ¼" per foot
- 1% slope can be used with approved clean outs at 1/8" per foot of fall.

You may not support one pipe with another, instead, fasten straps to the floor or chassis.




A combo fitting is a correct way to connect a second line to the system. Note the long sweep 90 degree connection.

The level shows the correct fall of 2% slope towards the outlet to the right.

Measuring from the sewer pipe to the chassis or floor is a good way to set the straps for correct slope. For 2% slope, lower the pipe 1” every 4’.

This section of pipes runs uphill for a section and must be re worked.

Straps must support sewer lines every 4'. Some inspectors require protecting the pipe with duct tape if using metal straps.

HEAT DUCT

Some manufacturers have the heat ducting crossovers built into the floor system and require only ensuring a good seal at the connections. Many manufacturers have from one to several flexible duct connections which are site installed. When site installing heat duct, I do it after I am finished with everything else under the home since it is very difficult to get around once in place. The manufacturer's installation manual will show details for the heat ducting, however it may be better to install the ducts and connections per recommendations of the air diffusion council, using three sheet metal screws to fasten the inner plastic tube and wire to the duct inlets. Once fastened, seal the coupling with a quality listed labeled duct tape. The insulation and outer plastic sheath should then be fastened over the inner connection with a tie strap or duct tape.

The duct should be strapped every 4' with approved straps of 1 ½" wide and the duct protected against chaffing with duct tape where the straps are placed.

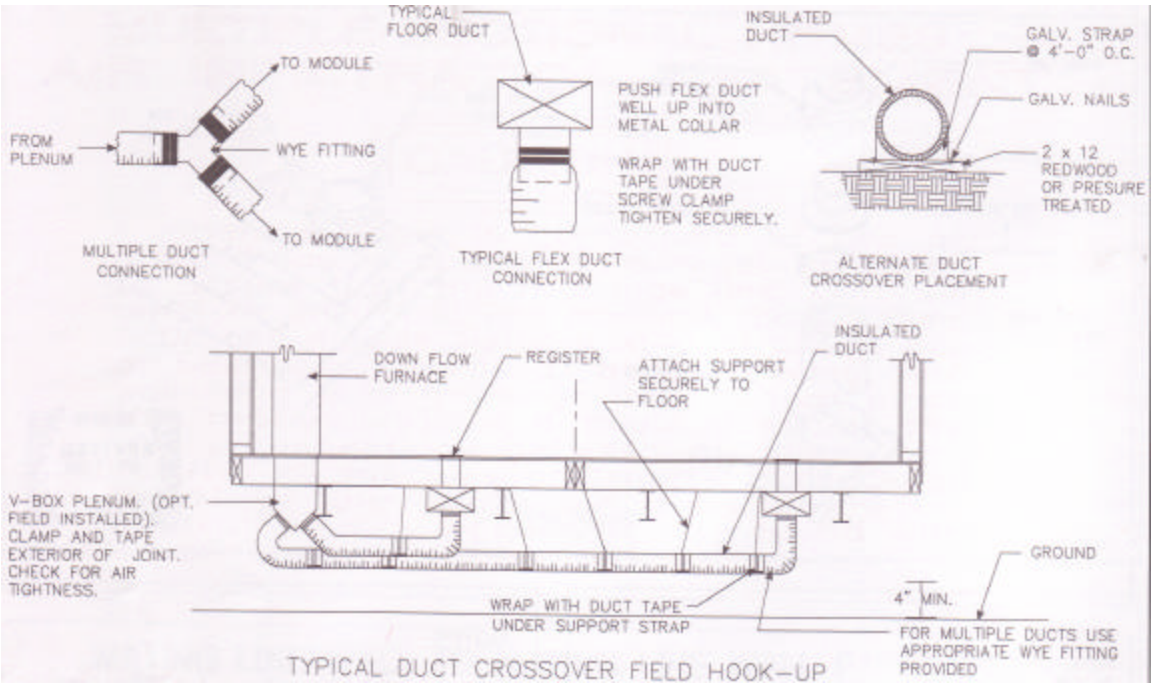
The duct should be a minimum of 4" off the ground or installed to an alternate plan such as placing on treated pads and strapping down to the pads.

Note this heat duct strapped up with recycled brake wire. The installation manuals generally do not specify the type of strap to use but the air diffusion council recommends 1 ½" sheet metal straps with duct tape wrapped to prevent chaffing of the duct.

This duct is supported with recycled brake wire. While it is performing adequately, it may not last the life of the home.

This is a correct strap; however, the duct should be wrapped with duct tape to protect it.

Here is an alternate heat duct support. The duct is placed on treated wood and strapped to it or placed on 4" plastic pipe to keep it off the ground.



TESTING UTILITIES

Water testing

Prior to connecting a water supply, check all water faucets and fixtures in the home and be sure the valves are turned off. The water supply pressure should be checked for pressure with a spigot pressure gage. If the pressure exceeds 80psi, the system may fail. Ideally, pressure should be 30 to 60 psi. A pressure regulator can be installed at the supply inlet if necessary. Do not connect a home to a supply source without knowing the pressure is acceptable.

Before connecting a properly regulated water supply to the home, go through the home and make sure all water valves are turned off. Check the dishwasher plumbing, Ice maker supply, washing machine supply, kitchen sink supply, bathroom sinks and toilets, bathtubs, shower fixtures and water heater. Next turn the water on and if all appears well, go through the home and energize each fixture, checking for leaks. If all is well, check under the home for obvious leaks. If any leaks are found, shut the water off outside at the supply gate valve and fix the problem. Once all appears well, fully open the gate valve and check everything again. The fixtures and valves must hold pressure with no leaks or drips. The system must be capable of holding 50 psi air pressure or live water pressure for 24 hours without leaking to pass inspection.

Common locations of water leaks are the loose supply tubes for appliances, loose water heater flex connections and missing valves at ice maker supply tubes.

Gas Testing

The gas can be tested two ways. The common method is to use an ounce pressure gage called a manometer. This is a low pressure test at 8 ounces or ½ psi. When testing this way, open the gas stand pipe valves to the appliances and set the regulator valve in the off position. If the gas stove has flame lit pilot orifices, the pilot tube valves must be screwed shut.

I like to cap the manometer and prove a good test with the manometer and connection fitting before hooking it to the home. With the gas pressure manometer installed, use either a tire pump or your mouth and blow the system up to the recommended pressure of 8 ounces of air pressure. The pressure must hold with no appreciable leak for 3 minutes. The pressure can change with cooling and heating of the air in the pipes. If the pipe is heated by the sun, expect the pressure to increase. If the test is left overnight, expect the pressure to be low from cooler pipes. Give the test time to stabilize and do a timed test. If tapping the gage causes a drop in pressure, suspect a leak. If the system leaks, start by closing all the gas stand pipe valves to eliminate appliance regulators and run the test again. If the leak remains, it is between the tester and the appliance valves, if it stops leaking, it is likely an appliance regulator or flex to the stand pipe valve. Open the valves one at a time, repeating the test until the culprit is located. Spray a soapy water solution on the suspect fittings or valves and try to locate the leak. If the regulator is leaking internally, cap the flex and prove a good test, then replace the regulator. Once fixed, repeat the test and ensure that after stabilizing it holds pressure for 3 minutes.

If the leak is before the stand pipes, pressurize the system and chase the leak with spray soap solution one fitting at a time until the offending leak is located. If that fails to find the leak, spray the pipes or try a different manometer.

The other method of testing, which is more common with site built homes calls for disconnecting the stand pipe valves, capping the stand pipes and testing the pipes to 15 psi for 24 hours. I have provided this test on a few occasions when an inspector refused to understand the other method. Once testing is complete and gas is tied in, soap test all the fittings involved in the connection and the valves, flex pipes and connections to the appliances if they were unhooked for the 15psi test.

On homes that have been stored for long periods of time, it is common for the gas regulators and stand pipe valves to leak. On new homes the systems are generally good except for occasional loose fittings and flex connectors.

ELECTRIC TESTING

A continuity test is performed to ensure that there is no continuity (closed circuit) between any of the 4 conductors or panel lugs. Check the following:

- Take out florescent tubes and light bulbs, unplug the bathroom fans, turn on light switches, unplug garbage disposals, turn off or unplug all appliances. Some hardwired stoves may need to be disconnected to prevent a bad reading. Unplug whirl pool tubs.
- Using a simple continuity test light or buzzer, clip the ground to the ground bar in the panel and check for continuity to the two hot bars in the panel and the neutral bar. If a continuity (the light shines) exists between ground and neutral, check for

hard wired appliances and fans that may need to be unhooked. If continuity exists between neutral and a hot leg, start turning off breakers until the troublesome circuit is isolated, then turn the others back on. Keep the troublesome circuit turned off until it can be identified and checked for plugged in appliances or fans.

- When testing is good, move the ground lead to the neutral and check it against the two hot leads. If it lights up, isolate the breaker that is problematic and search out the offending circuit. Again look for fan motors or appliances and unplug them.
- If problems remain unresolved, check all crossovers to ensure they are complete and match.
- Plug in a good extension cord to a receptacle in the middle of the home so the cord reaches the entire home. The home is not energized. Insert a #12 screw or similar into the ground receptacle on the extension cord and clip the ground lead from the continuity light to it. Chances are good that the receptacle you plugged into will have a good ground, but if it proves not to, move to a receptacle on the other side of the home.
- Take the test light and cord and room by room, check the receptacles, switches and fixtures for ground. The metallic fastener screws on the light switch and receptacle will ground to the unit. Check the electric fixtures and any hardwired appliances. Also any metallic pipes or heat ducts should be grounded.
- Often a circuit runs some distance and you may find a series of receptacles and switches with a bad ground circuit. Start at the two ends of the troublesome circuit and pull the units out to inspect the ground coming and going. If the problem cannot be located in a reasonable amount of time, defer it to factory service. Common causes for bad readings are plugged in bathroom fans, whirlpool tubs, garbage disposals, microwaves, refrigerators, installed florescent lights tubes, light bulbs, Hardwired dishwashers in an on cycle, hardwired stoves and ovens where the neutral wire is grounded to the junction box, plugged in stove or range with a clock, whole house fans turned on, missing wire nuts and grounded leads inside ceiling fan boxes and other similar items.

Sewer/ Drain testing

After the drain pipe is fully installed, the system must be tested. A common test is a flow test .Follow the procedures below:

- Install sink stoppers and fill sinks with water.
- Close bathtub drains and fill the tubs.
- Check under the sink basins for leaking around the bowls.
- Allow the sinks to drain one at a time while checking the sink drain pipes for leaks in the down spouts, traps and other plumbing. Snug up the traps and other loose fittings.
- Flush toilets and check for leaks around the tank, floor and supply plumbing.
- Allow bathtubs to drain.
- Runs showers for some time.
- Remove washing machine trap cover, connect a short section of hose and run the hose in the washing machine drain. Check the trap for leaks.

- With a flashlight, crawl the entire drain system looking for leaks.
- Check for bathtub and shower trap leaks.
- Look for rodent barrier swelled with water and investigate if water is found.
- Correct any leaks and repeat the test until there are no leaks.

Another common test is to fill the entire system and ensure it can hold water without leaking following the procedures below:

- Cap the outlet pipe.
- Install sink stoppers and fill sinks with water.
- Close bathtub drains and fill the tubs.
- Check under the sink basins for leaking around the bowls.
- Allow the sinks to drain one at a time while checking the sink drain pipes for leaks in the down spouts, traps and other plumbing. Snug up the traps and other loose fittings.
- Flush toilets and check for leaks around the tank, floor and supply plumbing.
- Allow bathtubs to drain.
- Runs showers for some time.
- Remove washing machine trap cover, connect a short section of hose and run the hose in the washing machine drain. Check the trap for leaks.
- Run water until there is standing water in the showers or tubs being careful to not allow it to over flow.
- With a flashlight, crawl the entire drain system looking for leaks.
- Check for bathtub and shower trap leaks.
- Look for rodent barrier swelled with water, drain, investigate if water is found, air dry, repair and close up.
- Correct any leaks and repeat the test until there are no leaks.

Speakers

Some units have built in stereo systems that have speaker wire crossovers. Often the crossovers are not marked for proper crossover and the unit may first have to be energized so functional tests can verify the crossover connections. Factories should ensure proper labeling to increase the odds of a correct installation.

Sprinklers

Sprinkler systems are required in increasingly more jurisdictions. Some jurisdictions require a licensed sprinkler contractor make the connections and test the system.
The following are some of the items to consider for sprinkler systems:

- There is a crossover connection between sections of the home which may consist of a slip glue fitting or union fitting. If they are misaligned, correct fittings and glue will be needed to correct the placement.
- The system will have a manifold with a flow switch and gauges. From the manifold a drain pipe of usually ½" copper will have to be stubbed out from the home and directed towards the ground.

- The system will have a supply pipe of usually 1" or 1 ¼" copper pipe which will need an adequate volume and pressure of water.
- The main supply must not be shut off when the home supply is shut off so that the system remains operable even when the home has no supply for domestic use.
- The PVC system must usually be tested to 100 psf and not the standard 200 psf which is common in stick built structures with metalic hard piping. The manufacturer should be able to provide the approval for the lower pressure testing and a warning letter that suggests higher pressure tests may cause system failure or damage. This improvised test pressure may cause problems with the enforcement office who is usually a high ranking fire official. Since it can be a challenging battle, I defer the project to a sprinkler contractor with the pressure information stated above.
- Occasionally the roof crossover connection can fail, causing substantial water damage to the home. I charge a risk management fee of $500.00 per home to make the connection since I have paid for water damages a couple times.
- Sprinkler testing consists of opening a test valve, causing water to flow through the system, which causes a flow valve at the manifold to switch on the fire alarms. They must ring within a certain period of time and be adequately audible.
- The sprinkler system must have a repair box with extra sprinkler heads of varying temperatures and wrenches, placed in an acceptable location.
- The system works when a sprinkler head is heated to the rated popping temperature that allows the valve to turn on at that sprinkler head only. If more heads get hot and pop, they will start to flow also. When water moves through the system, the alarms sound. The system cannot be shut off except at the water meter valve or well valve.

Smoke alarm testing

Most smoke alarms provided by the home manufacturers are powered by household voltage and a 9volt back up battery. Test the alarms as directed in their instructions and install fresh alkaline back up batteries.

QUICK CHECK LIST FOR UTILITIES CROSSOVERS, STUB OUTS

ELECTRIC:

- ELECTRIC CROSSOVERS CONNECTED BUT NOT YET SEALED IN FLOOR
- STEREO CROSSOVERS
- CONTINUITY TEST SUB PANEL
- CONTINUITY TEST RECEPTACLES AND FIXTURES
- LIVE ELECTRIC TEST ALL FIXTURES
- STEREO CHECKED FOR CORRECT SPEAKER FUNCTION
- ELECTRIC CROSS OVERS FASTENED TO PLAN
- NAIL PLATES AT CROSSOVERS
- ELECTRIC SERVICE
- FAN AND AC BOX COVERS INSPECTED

OTHER UTILITIES

- GAS CROSS OVER AND STUB OUT
- GAS PRESSURE TEST
- WATER CROSSOVERS AND STUB OUT
- WATER PRESSURE TEST
- SEWER LINE ASSEMBLED
- SEWER LINE TEST
- HEAT DUCT TO PLAN
- HEAT DUCT STRAPING
- HEAT DUCT OFF GROUND TO PLAN
- UTILITIES SUPPORTED 4’ O.C. ALL
- ANTI SIPHON VALVES
- RODENT BARRIER
- SPRINKLERS CROSSOVERS

BONDING:

- GAS BOND
- WATER BOND
- CHASSIS BONDS
- UFFR GROUND CONNECTED

VENTING

- FIRE PLACE INTAKE UNCOVERED
- DRYER DUCTING
- JEN AIRE VENT

TESTING

- GAS PRESSURE 8 OUNCES, 3 MINUTES
- WATER PRESSURE 50 PSF 24 HOURS OR LIVE TEST
- SEWER FLOOD TEST
- ALL FIXTURES FLOOD TEST
- TOILETS ADJUSTED, DO NOT RUN OVER, SNUG TANK TO BOWL TO FLOOR
- INSPECTION CALL IN AND INSPECT
- INSPECTOR SIGNS OFF ON PERMIT

FACTORY SERVICE NEEDED:

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