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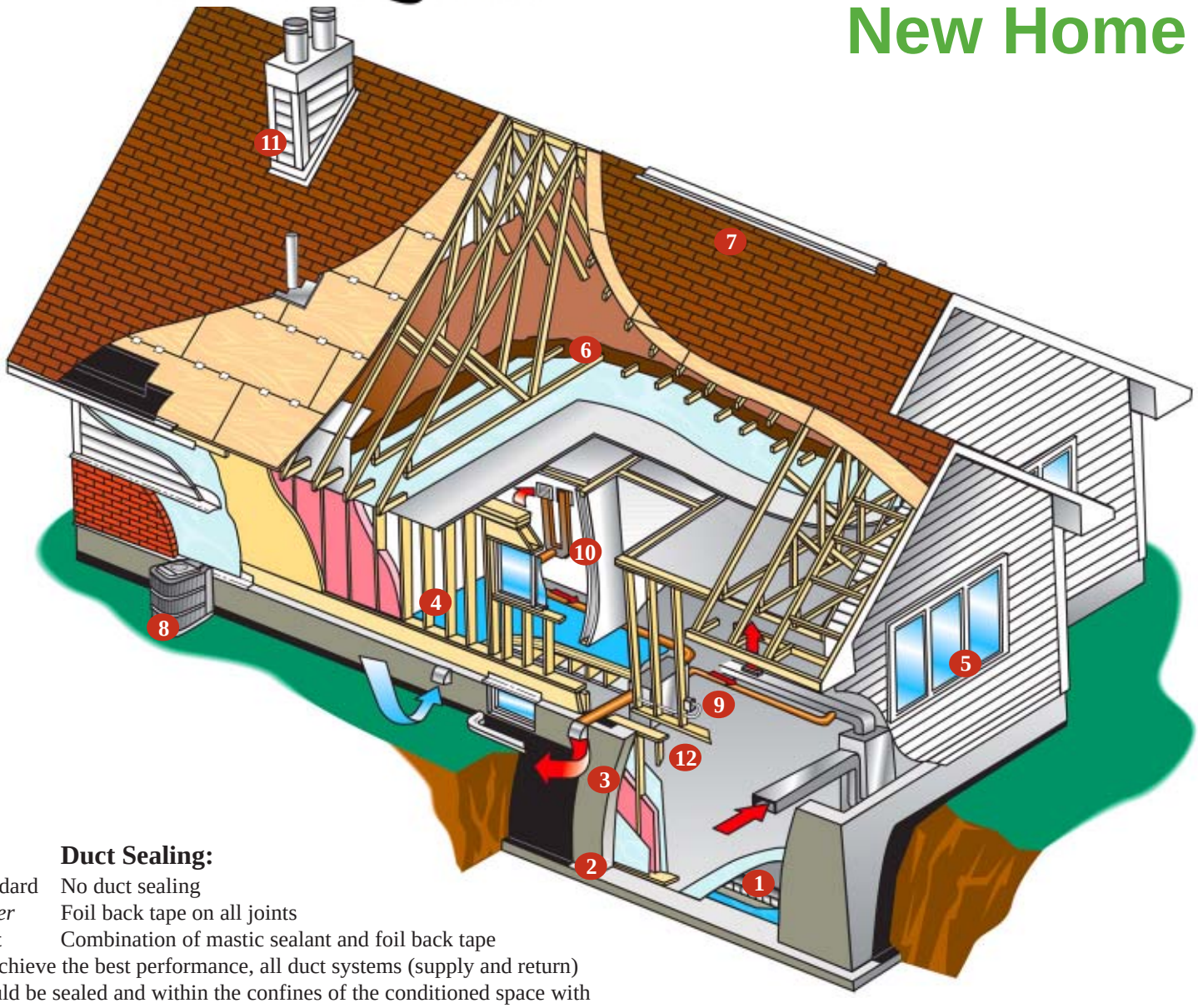
Building Technology Options for Your New Home



10 Duct Sealing:

Standard No duct sealing
Better Foil back tape on all joints
Best Combination of mastic sealant and foil back tape

To achieve the best performance, all duct systems (supply and return) should be sealed and within the confines of the conditioned space with little or no flex duct.

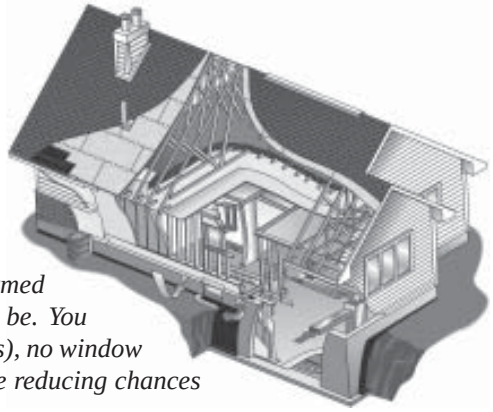
11 Fireplaces:

Standard Wood burning fireplace with glass doors
Better Wood burning or gas fireplace with airtight glass doors
Best Sealed combustion direct vent gas fireplace

12 Electrical & Plumbing:

All electric and plumbing penetrations in exterior walls or through the ceiling area should be foamed. Recessed lighting fixtures that extend into an unconditioned area should include airtight enclosures. All electric outlets and switches on exterior walls and ceiling light fixtures should also utilize airtight boxes.

Construction Terminology and Explanations



Building a new home is probably the largest investment you'll make in your life. The more informed you are, the more energy efficient, healthy, safe, durable, and comfortable, you're home will be. You should expect low energy costs, even temperatures throughout the home (with no hot or cold spots), no window condensation, all health and safety issues addressed, and the building's shell to be durable while reducing chances for moisture problems.

We would like to inform you about the latest technologies for your new home that meets, or exceeds, your expectations of how your new home will perform as a system. If you're concerned about how your new home will perform in the areas of health, safety, durability, low energy costs and comfort, then you must address these issues before construction.

Insulation - Two basic types of insulation used for residential construction are fiberglass, batt or blown in loosefill insulation. Batts are either fiberglass or rock wool spun together to form a continuous piece of insulation. Insulation is rated by its R-Value, which determines the resistance to the flow of heat. The higher the R-Value the greater the insulating efficiency. Insulation ranges in R-Value, from R-11 to R-38. Loose fill insulation includes any of the above substances and is blown into ceilings or stud walls.

Exterior Stud Wall Insulation - Exterior stud wall insulation comes as fiberglass or rock wool batts. Another popular option is blowing fiberglass, cellulose or spray foams into wall cavities. These products are denser than batts and slow the flow of heat and air infiltration. Remember, the higher the R-Value, the greater the insulation efficiency.

Exterior Sheathing - Exterior sheathing is applied to the exterior of the stud wall before the exterior finish is attached. Exterior sheathing can be blackjack, plywood, Orient Stranded Board (OSB) or any of the foam (extruded or expanded polystyrene, polyurethane, or Styrofoam) boards available on the market. Foam boards achieve higher R-Values in the wall section.

Exterior Air Barriers - Exterior air barriers are products that keep infiltration of outside unconditioned air from entering the building. These products are impermeable to air flow but permeable to moisture flow. Moisture travels through them to increase the drying potential of the building's shell, but air does not pass through it. Foam boards also serve the same purpose but all joints must be taped.

Indoor Vapor Barrier - Vapor barriers control the flow of exfiltration of conditioned air, which is moisture laden, into the wall sections. Vapor barriers are a polyethylene plastic that are impermeable to moisture movement, and are installed before the drywall. They are always installed on the warm side of the home since Nebraska is in a heating climate. The vapor barrier should be continuous with all joints taped or caulked to make the wall section as airtight as possible. Moisture in the vapor form that is allowed to enter the wall section can result in condensation, which creates a structural durability issue.

Concrete Basement Walls - Concrete is not a good insulator, Concrete walls above grade and up to two feet below grade lose about as much heat as a double-pane window. Since the basement area is often finished for additional living space, insulating these walls results in substantial energy savings and improved comfort. Basement walls are generally insulated on the interior with either batt insulation or foam products. For best performance, utilize insulated concrete form walls.

Basement Floor - Concrete floors with interior drain tile only, can result in moisture and radon movement into the home. Concrete is a permeable product, so moisture moves through it. To prevent this from occurring, it is recommended that a polyethylene product be installed under the basement slab. Also, select a sealed sump pump pit that is vented to the outside. This will vent any buildup of moisture or radon directly to the exterior if pressure differences occur between the home's indoor environment and the earth.

Ceilings - Ceilings come in many forms. There are flat ceilings with attic areas above, cathedral ceilings with attic area above, cathedral roof-ceilings combination, or a flat roof-ceiling. New residential construction is generally insulated to an R-38, but this will vary depending on the ceiling-roof type. Most ceiling insulation is blown in. It is extremely important that penetrations (i.e., recessed lighting, plumbing stacks, flues, electric wiring through top plates, supply and return air ducts) be sealed with foam or caulking to accomplish air sealing and to keep stack effect to a minimum. Stack effect occurs in every home. It is driven by the temperature difference between indoor temperature and outdoor temperature. (Stack effect is best described as rising hot air that is bouncing off the ceiling). Conditioned air leaks out of buildings wherever there is a penetration in the ceiling. Every cubic foot of conditioned air that leaves the structure, is replaced with one cubic foot of unconditioned air that must now be conditioned (heated or cooled, which costs money). The building industry is debating whether vapor barriers should be installed in ceilings. If an energy recovery ventilator (ERV) is installed, a vapor barrier in the ceiling is recommended. If the home has no ERV, do not install a vapor barrier in the ceiling.

Windows & Doors - Windows and doors lose or gain the most heat of all the building's components, thus, selection is critical. In recent years, the window industry has developed warm edge spacers, Low-E coatings, low-conductance gases, improved weather-stripping and triple-pane windows. Windows are rated by U-Values. The lower the U-Value the more efficient the window. The minimum per Nebraska Energy Code is .32 u value. Providing a tight building shell with an average performing window can result in serious condensation on the windows during the heating season. The National Fenestration Rating Council (NFRC) has developed a window energy rating system which compares window performance of participating manufacturers. It will provide information containing U-Value, solar heat gain coefficient, visible light transmission and air infiltration rates.

HVAC (Heating, Ventilation and Air Conditioning) - Heating and cooling equipment efficiencies are rated as follows (the higher the number the more efficient the equipment and the lower your annual heating and cooling costs):

Air source air conditioners - Seasonal Energy Efficiency Ratio (SEER).
Air source heat pumps - Cooling mode, SEER. Heating mode, Heating Seasonal Performance Factor (HSPF).
Water source heat pumps - Cooling mode, (EER). Heating mode, Co-Efficient of Performance, (COP).
Natural gas or propane furnaces - Annual Fuel Utilization Efficiency (AFUE).

The United States Department Of Energy (DOE) has set minimum equipment efficiencies with the installation of new equipment:
Air source air conditioners and heat pumps - 13 SEER, 6.80 HSPF
Water source air conditioners and heat pumps - 15 EER, 2.80 COP
Natural gas or propane furnaces - 78 percent AFUE

Two publications compare HVAC equipment efficiencies. The Air-Conditioning & Refrigeration Institute (ARI) lists efficiencies for air conditioners and air and water-source heat pumps. The Gas Appliance Manufacturers Association (GAMA) lists efficiencies for gas and electric furnaces and water heaters.

Open combustion gas furnaces and water heaters compete for air with other air exhausting appliances in the home (bath fans, clothes dryers and central vacuums). With today's building industry encouraging tighter home construction, exhausting appliances may replenish their air supply by drawing outside air into the home through the flue. This can become a health and safety concern if a gas furnace or water heater ignites but is unable to overcome the cold air coming through the flue. In this situation, carbon monoxide can spill into your home. For your health and safety, it is recommended that you install a sealed combustion furnace and water heater, or an electric heat pump with an electric furnace and water heater. Electric heating equipment requires no flue and eliminates any possibility of carbon monoxide poisoning.

The sizing of heating and air conditioning equipment is critical. It is the heating contractor's responsibility to correctly size the equipment. Equipment that is too large or too small will result in poor performance with hot and cold spots throughout the home and higher energy costs.

Exhaust Ventilation - Ventilation is intended to remove moisture and odors. The Home Ventilation Institute (HVI) sets guidelines of eight air exchanges per hour (ACH) for bathrooms. Proper ACH ensures moisture is removed from this area without causing structural deterioration.

General Ventilation - The American Society of Heating Refrigeration and Air Conditioning Engineers (ASHRAE) Standard 62-1989 provides guidance on general ventilation and indoor air quality. Recommended ventilation is 15 cubic foot of air per minute (CFM), per person. Typically, this equals a one-third exchange of air per hour in a residential home. Providing the proper air exchanges per hour can be accomplished with exhaust fans, open windows or an air-to-air heat exchanger . An air-to-air heat exchanger exhausts stale indoor air and replaces it with fresh outdoor air. There are two types of air-to-air heat exchangers: heat recovery ventilators (HRV) and energy recovery ventilators (ERV). ERVs are recommended for our climate because they have the capability to remove unwanted moisture during the heating season. These machines can transfer up to 80 percent of sensible and latent heat from the stale moisture-laden air that is exhausted to the incoming fresh air being delivered to the home. Air-to-air heat exchangers can be installed at the time of construction or retrofitted into and existing home.

Ducts - The duct system is a direct extension of the heating and cooling equipment. It is the heating contractor's responsibility to determine duct size. Sealing your duct is important to your comfort and recommended per Nebraska Energy Code it is estimated that nationwide, duct systems leak 20-30 percent of the air they carry. This not only results in comfort problems, but it also causes pressure imbalances within the home. These problems may effect health and safety, durability, comfort and energy efficiency. Seal duct systems with a mastic product and foil back tape. Location of the duct system can also affect performance and comfort. Ducts should be installed within the conditioned space. Duct systems located in unconditioned spaces (attic or crawl space) automatically increase energy costs 10-15 percent.

Air Sealing of the Thermal Shell - The amount of air sealing applied to the thermal shell determines the comfort level in your home. Air sealing also has a direct impact on annual heating and cooling costs. Air sealing will keep unconditioned air from entering the home and conditioned air from leaving the home. Typical air infiltration into the home can increase annual heating and cooling costs 30-40 percent. It is recommended that you seal your home with caulking, expanding foam sealants, and airtight plastic boxes. Any penetration from the conditioned space to the unconditioned space should be sealed. Be sure to seal window and door jambs, sillbox areas, ceiling penetrations, and air ducts that extend into unconditioned areas.

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1 Basement Floor:

Standard 4-inch concrete floor
Better 4-inch concrete floor with drain tile and sump pit
Best 4-inch concrete floor, drain tile, sealed sump pit vented to exterior and high-density polyethylene under concrete floor

2 Basement Concrete Walls:

Standard 8-inch concrete
Better 8-inch concrete with 1 1/2 inches of Styrofoam
Best Insulated Concrete Form walls with R-20 foam insulation

3 Sillbox-Bandjoist Area:

Standard R-13 batt insulation
Better R-19 batt insulation
Best Airtight sealing (gasketing, caulk, foaming)

4 Stud Walls:

Standard 2x4 studs, R-13 batt insulation, blackjack sheathing, indoor vapor barrier
Better 2x4 studs, R-14 blown insulation, plywood or blackjack sheathing, exterior air barrier and indoor vapor barrier
Best 2x6 studs, R-20 blown insulation, plywood or foam sheathing, exterior air barrier, indoor vapor barrier, airtight sealing

5 Windows & Doors:

Standard Double-pane glass
Better Double-pane glass with Low "E" coating
Best Triple-pane glass with Low "E" coating

6 Ceiling Areas:

Standard R-30 blown insulation
Better R-38 blown insulation
Best R-45 blown insulation with indoor vapor barrier and air sealing on all penetrations from living space into unconditioned areas

7 Roof-Attic Ventilation:

Attic ventilation is a requirement for moisture removal during the winter months and sensible heat removal during the summer months. Proper ventilation sizing requires 1/300th of the square footage of the attic area, or one square foot of ventilation, one-half in high roof and one-half in soffits, for every 300 square feet of attic area.

8 HVAC:

Standard 78% AFUE gas furnace with 13 SEER central air conditioner
Better 13 SEER air source heat pump with electric air handler or 12 SEER air source heat pump with 90% AFUE sealed combustion gas furnace
Best Closed loop water source heat pump with variable speed air handler. Or, 15-20 EER air source heat pump with variable speed electric air handler. Or, 15-20 EER heat pump with 96% AFUE sealed combustion gas furnace It is recommended that two-story homes have two HVAC systems: One for the first floor and basement and one system for the second floor only. One system can result in the second floor with 4-8 degrees warmer than the first floor during the cooling season. This is generally unacceptable to most home owners. If one system is selected, the second floor should include zone controls so it can operate independently from the first floor zone. It is also recommended that a humidifier be installed for winter comfort and a permanent filter media. This can be an electronic air filter or a permanent type of pleated filter.

9 Ventilation:

Standard Standard bath fans
Better Upgrade bath fans that have a low sone (sound) rating and that meet performance criteria of the bathroom's required exhaust
Best Source point ventilation with an Energy Recovery Ventilator (ERV)