INSULATION

Weatherization Assistance Program
Indiana Field Guide

INSULATION OF BUILDING ENVELOPE

STANDARD - THERMAL BOUNDARY

Establish the thermal boundary for the building. The thermal boundary is comprised of the building surfaces completely encompassing the intentionally heated areas of the building. Inspect the construction details, materials used and insulation levels of each component of the thermal boundary to determine the R-values, structural integrity and insulation options.

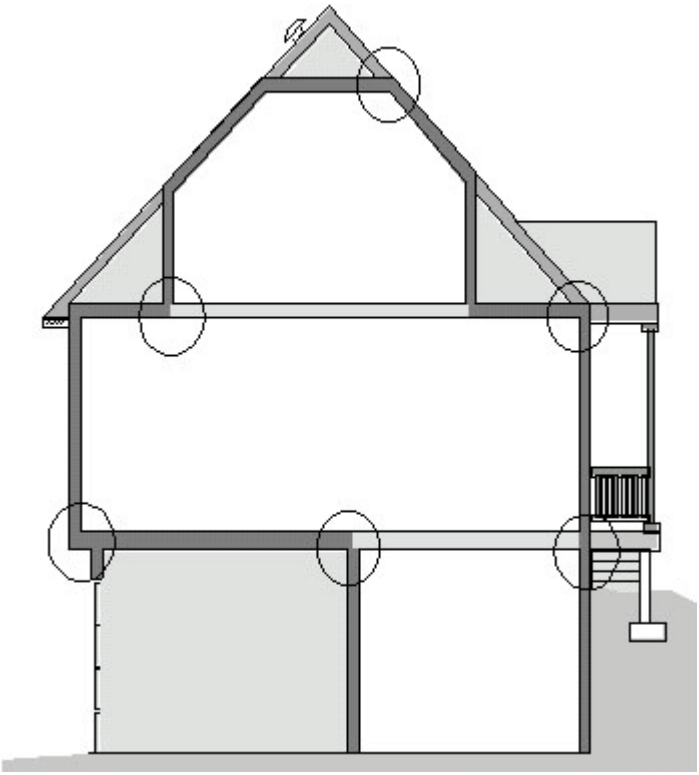
Procedure - Thermal Boundary Inspection

- All attics must be accessed for inspection. (for insulating procedure, see page 6-8)
- Inspect floored attics by pulling boards or drilling holes to determine existing insulation levels. (for insulating procedure, see page 6-6)
- Inspect sidewalls by accessing cavities from the attic or cellar, pulling electrical outlet covers, drilling small inspection holes (interior) or by removing exterior siding and drilling inspection holes in the sheathing. (for insulating procedure, see page 6-4)
- Inspect mobile home floor cavities by lifting supply registers and looking alongside duct boots or by making openings in the rodent barrier.
- Inspect mobile home roof cavities by drilling a hole through the ceiling material in a relatively inconspicuous location like a closet or furnace alcove.
- Inspect mobile home wall cavities by removing siding screws from the bottom of the wall in an area 3 or 4 feet wide. Carefully pull the siding away to inspect for available space to add insulation.
- Protective equipment shall be worn at all times by workers to protect their heads, eyes, hands and respiratory systems from injury.

Dense Pack Cellulose

Density Chart

Wall or Floor Depth		Typical Pounds of Material per Square Foot
3 1/2”	=	1.2 - 1.3
6”	=	2
9”	=	3
12”	=	4
(or 4 lbs per cubic foot)		



Thermal Boundary Details

INSULATION OF BUILDING ENVELOPE - SITE BUILT HOMES

STANDARD - WALL INSULATION

Conductive losses should be reduced through insulation of the building's thermal envelope. Wherever possible, cellulose should be installed utilizing high density techniques to reduce convective losses as well. Proper installation ensures that insulation achieves its optimum thermal performance. Insulation exposed in a conditioned space must be covered with an effective air/fire barrier that has a durable surface. Insulation must be installed at a rate of 4 pounds per cubic foot to meet the specifications to be considered high-density.

Procedure - Wall insulation

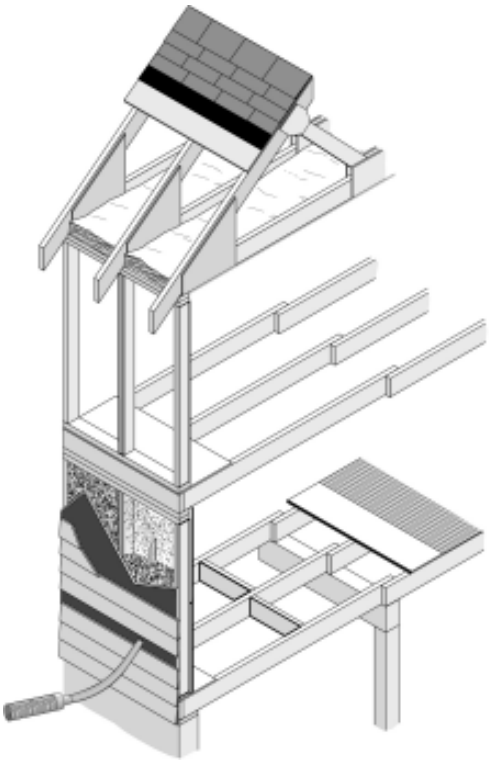
- Visually inspect the interior and exterior portions of walls receiving insulation for knob and tube wiring, heating system ductwork, holes, and structurally weak areas, i.e. poorly attached drywall or loosely attached plaster/lath.
- Remedy problems found during interior/exterior sidewall inspection prior to installing insulation products in sidewall cavities or do not insulate.
- All blown-in sidewall insulation should be installed high density so as to fill all voids in the thermal envelope, restrict airflow in the wall cavities, and to eliminate settling of insulation in the wall cavities.
- For exterior retrofit, siding should be removed before drilling sheathing to inject insulation through a flexible tube inserted into and at the top of each cavity. Direct blowing through a nozzle should be limited to short cavities such as those above windows and doors.
- If access to the wall cavities is not practical from the exterior, disturb the building as little as possible when gaining access to the wall cavities from inside the thermal envelope. Possible interior wall cavity access points are through the attic, from the basement, above suspended ceilings, behind chair rail or baseboard and through the wall finish. (see lead safe work procedures, page 3-40)

- Ensure that all key critical junctures in the thermal envelope receive strategic dense pack treatments so as to stop air paths *(See Image preceding page).*

  Some of these areas include: band joists at each floor, cantilevers, intersecting partition walls, kneewall floor intersections, sloped ceilings, floors over unconditioned areas, unusually large openings around doors and windows. For double hung windows with weights, insulate weight cavity with cellulose.

- All wall cavity access points should be airsealed following insulation installation.
- Conventional 1" drill and blow method is no longer advocated by FSSA as the standard procedure for insulation walls. It is acceptable for areas above windows and doors for accessing small areas. It is acceptable where the interior wall is very thin or weakened to the point where it will not withstand the pressure necessary to produce high density.

Installing High Density Wall Insulation from the Outside



ATTICS

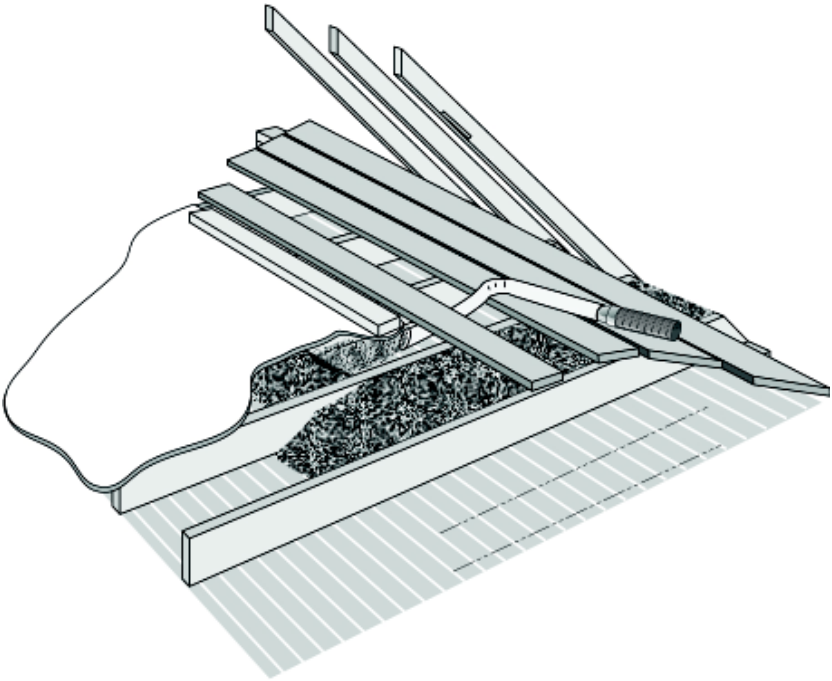
STANDARD - FLOORED ATTICS

All floored attics should receive high density insulation whenever practical. All areas should be accessed to ensure complete coverage of insulation. Insulation density should be as stated for closed wall cavities.

Procedure - Floored Attics

- Visually inspect all ceilings under floored areas for holes, weaknesses; remedy any problems found before proceeding.
- Drill or remove flooring to ensure access to all areas requiring insulation.
- Inspect each bay for knob and tube wiring, thermal bypasses, open electrical boxes, blocking and recessed lighting fixtures. Treat appropriately if problems are found.
- Seal accessible bypasses and alleviate health and safety concerns before installing insulation. Have questionable electrical wiring checked/repaired/ approved by a licensed electrician.
- Block around hot or potentially hot objects such as chimney/flues and recessed lighting fixtures before installing cellulose insulation.
- Blow cavity full of insulation - 2" or greater hose, high air setting, moderate material feed rate is preferred for attic floor closed blow dense pack applications.
- Reinstall any flooring removed and plug any holes drilled.

Closed Blow Attic Insulation



Inspect each cavity prior to insulating. Use a 2” or larger hose, high air setting and moderate material feed rate to ensure coverage.

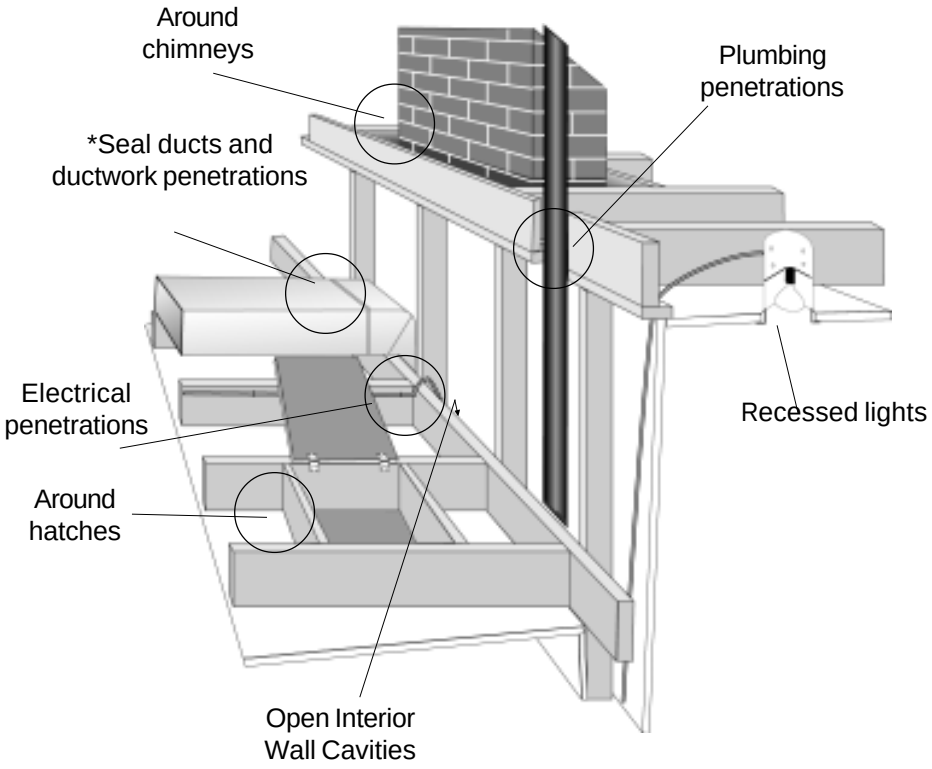
STANDARD - OPEN JOIST ATTIC INSULATION

Open joist attics must receive comprehensive airsealing and other preparations prior to insulating.

Procedure - Open Joist Attic Insulation

- Air seal all plumbing, electrical penetrations, chimney causeways, open partition wall cavities, and any other holes leading to the attic from the living space or from framing pathways.
- Place vertical blocking around access panels, hatches, lighting fixtures, chimneys and flue pipes. Meet local fire protection codes.
- Run blower door to -50 Pa and use a manometer to measure attic WRT main body of house. Pressure difference should be 45 Pa or greater. If not, check ceiling for leakage before insulating. Seal as necessary.
- Insulate to an R-38.
- Install an Insulation Certificate. Flag all electrical junction boxes for easier locating if needed at a later time.
- For open blown-in applications, minimize air and maximize material setting within the performance capabilities of the insulation blowing machine, to minimize dust generation and to reduce settling.

Open Blow Attic Insulation



Sealing bypasses in attics reduces energy loss and moisture migration into the attic, and assures proper performance of the insulation.
* Be sure to check any duct sealing with a blower door and pressure pan.

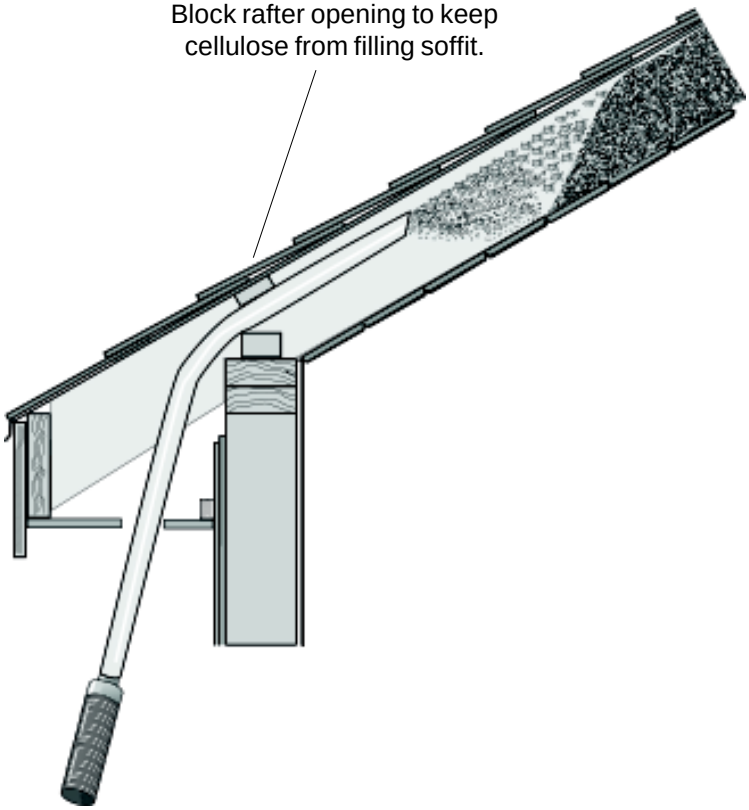
STANDARD - RAFTER CEILINGS

Flat roofs, attic areas and cathedral ceilings not readily accessible that are a part of the thermal boundary shall be treated with insulation.

Procedure - Rafter Ceilings

- Inspect interior ceiling finishes for unsound/weak areas. Stabilize weak areas found.
- Inspect roof for evidence of failure. Problems found must be corrected prior to installing insulation.
- Access cavities through soffit/fascia, roof deck or interior ceilings, or attic area below ridge.
- Inspect each bay for knob and tube wiring, thermal bypasses, open electrical boxes, blocking and recessed lighting fixtures, and prepare as needed.
- Seal bypasses and alleviate health and safety concerns before installing insulation.
- Insulate cavities with high density insulation.
- Airseal and weatherproof access point.

Dense Pack Roof Cavity



High density insulation being installed in a rafter ceiling must be protected from moisture from both inside and outside sources. Verify roof condition and seal bypasses prior to installing insulation. Example shows access to roof cavity through soffit.

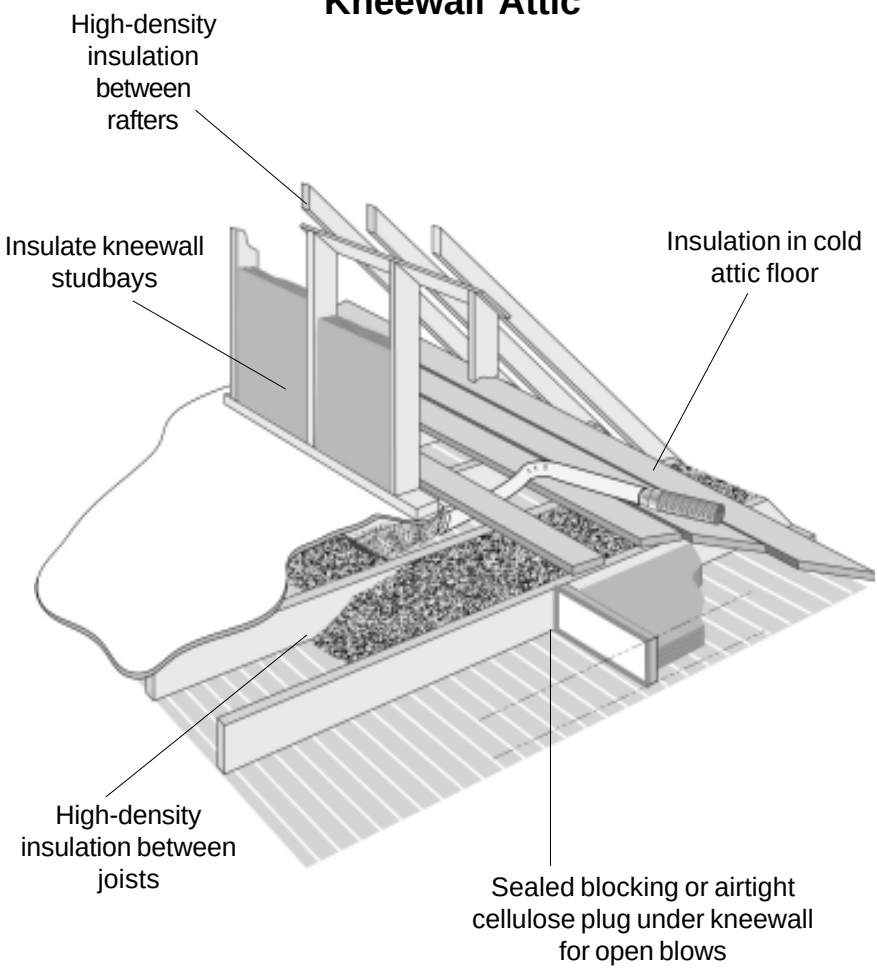
STANDARD - KNEEWALLS

Kneewall attics shall be treated to ensure a complete and continuous thermal barrier.

Procedure - Kneewalls

- Install blocking or blow cellulose plug in ceiling joist beneath kneewall for open blow applications.
- Foam blocking to airseal.
- Install insulation in the attic to the required level.
- Run blower door to -50 Pa and use a manometer to measure attic WRT main body of house. Pressure difference should be 45 Pa or greater. If not, check ceiling for leakage before insulating. Seal as necessary.
- For open blown-in applications, minimize air and maximize material setting within the performance capabilities of the insulation blowing machine, to minimize dust generation and to reduce settling.
- Insulate floor joist below kneewall bottom plate with high density insulation, in closed blow applications.
- Insulate to an R-38.
- Install insulation between studs of kneewalls using spray on cellulose or dense pack behind insulation fabric. If batt insulation is used, install vapor barrier towards warm side and protect the cold side of the insulation with a continuous air barrier (“house wrap”). Insure that rafter cavity is blocked above kneewall top plate to withstand dense packing from above.
- Insulate ceiling rafter cavities (of the living space, above kneewall) with high density insulation.
- Insulate flat ceiling area above slope to required insulation depth.

Kneewall Attic



Kneewall attics require careful insulation and airsealing techniques to provide an effective thermal boundary.

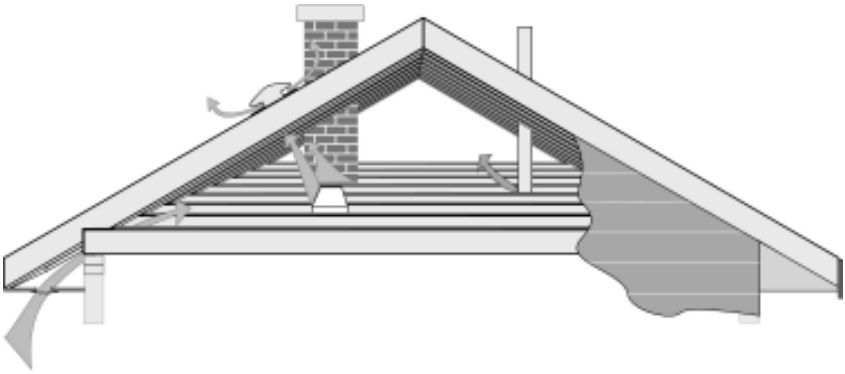
STANDARD - ATTIC VENTILATION

Attic ventilation through intentional openings is designed to reduce temperature and moisture buildup. It should not be relied upon to solve moisture problems.

Procedure - Attic Ventilation

- Since moisture is carried into an attic by any warm air exfiltrating from the main body of the building, airsealing the attic floor, before insulating or under existing insulation, will reduce the amount of moisture entering this area and the need for attic ventilation.
- If an attic does not have an existing moisture problem, there is little chance that energy conservation measures will cause one, and no added ventilation is required.
- If an attic does have an existing moisture problem, The source of the problem should be located (roof leak, thermal bypass, etc.) and any necessary action be taken to solve the problem.
- If ventilation is to be added it must meet one of these standards:
    - If there is a vapor barrier present or 1/2 high/ 1/2 low distribution of vents can be achieved, there should be one square foot of ventilation for every 300 square feet of attic floor space.
    - Without the presence of an air barrier or high/ low distribution vents, there should be one square foot of ventilation for every 150 square feet of attic floor space.

Attic Ventilation



Sealing bypasses and penetrations is the best way to avoid moisture build up in an attic. Thorough air sealing and careful insulation are also the best way to avoid ice dams in extreme winter conditions.

BASEMENTS AND CRAWL SPACES

Treatments in this area depend on whether the basement or crawl area is included in the thermal boundary or it is outside the thermal boundary. If the floor is made the thermal boundary, the ducts and water pipes must be insulated as well. If the perimeter is the thermal boundary, everything else in the crawl is much less vulnerable. The perimeter treatment will be much less expensive and time consuming. FSSA advocates, as a default procedure, that the perimeter be made to be the thermal boundary and receive appropriate treatment.

STANDARD - BASEMENTS AND CRAWL SPACES

Basement and crawl space areas are often unintentionally heated , or tempered, spaces. Typical heat sources include furnaces, distribution systems and water heaters.

Procedure - Basements

- Airseal all penetrations to the conditioned space.
- Insulate entire band joist with R-19 fiberglass with vapor barrier facing outward.
- Airseal major penetrations from basement zone to outdoors.
- Insulate basement walls with fiberglass insulation (usually duct wrap insulation) from the subfloor running down the basement or crawl wall to a level two feet below grade.
- Following basement retrofits, perform a daily safety test out to ensure occupant health and safety.

Procedure - Tempered Crawl Spaces

- Airseal all penetrations to the conditioned space.
- If the tempered crawl space has a dirt or gravel floor install a continuous vapor barrier over ground extending 12-16” up the foundation.
- Insulate entire band joist with R-19 fiberglass with vapor barrier facing outward.
- Airseal major penetrations from basement zone to outdoors.
- Insulate basement walls with fiberglass insulation (usually duct wrap insulation) from the subfloor running down the basement or crawl wall to a level two feet below grade.
- If crawl space is also a combustion appliance zone (CAZ), following tempered crawl space retrofits, perform a daily safety test out to ensure occupant health and safety.

DUCTS

STANDARD - DUCTS

If ducts are located outside the thermal boundary, such as garage, attic, or open crawl space, they are to be insulated in the Site Built Home Waiver Priority List, priority #5. Also, (if retrofit chosen) if ducts located in a tempered location, they are to be treated in a similar fashion, but are a lower priority (Waiver Priority List #9, Foundation Insulation or Duct Insulation).

Procedure - Duct Insulation

- Ducts must be airsealed prior to insulating.
- Use fiberglass duct wrap with vapor barrier shell facing outside.
- Pieces of duct insulation must overlap and be taped along the edges. Adjoining pieces must fit together snugly and be taped along the edges.
- All duct insulation is to be secured using cable ties or tie wire or similar material so as to not rely on the tape to secure insulation in place.

INSULATION OF BUILDING ENVELOPE - MOBILE HOMES

Determine the thermal boundary as you would for a site built structure. Inspect the construction details, materials used and insulation levels of each component of the thermal boundary to determine R-values, structural integrity and insulation options. Because of the unique structural characteristics of manufactured homes, extra caution and modified installation procedures are required in order to insure the durability of the measure.

- All three of the possible mobile home insulation measures, floors, roofs and walls, are predicated on the level of existing insulation as well as the empty cavity space available for additional insulation. Follow the guidelines specified in the Mobile Home Waiver Priority List.
- Fiberglass is the preferred insulation material for use in mobile homes. It is the only material appropriate for mobile home roof and wall cavities. For the time being, cellulose may still be used in mobile home floor cavities.
- Caution should be used when blowing loose fill material in mobile homes. Air pressure and material density should be reduced from levels common in site built weatherization so as not to unduly stress rodent barriers, interior wall surfaces, ceiling and roofs.
- The electrical system and its components shall be examined as part of the process of determining if insulation measures are appropriate for a given home. Care shall be taken during installation procedures to avoid stress or damage to house wiring.

STANDARD - FLOOR CAVITY

Mobile home floor cavity shall be treated with insulation to ensure a complete and continuous thermal barrier.

Procedure - Mobile Home Floor Insulation

- Repair underbelly as necessary and airseal penetrations.
- Install vapor barrier on ground covering entire area under mobile home.
- Water supply and drain pipes should be insulated to protect from freezing.
- The heating duct should be enclosed within the installed insulation. If not, add insulation below the duct. Air seal duct prior to insulating.
- Access floor cavity through the rim joist or the underbelly and fill the floor cavity with insulation. Use a rigid tube when accessing through the rim joist. Use a flexible sidewall hose when accessing through the underbelly.
- Patch access holes with appropriate material upon exit.

STANDARD - ROOF CAVITY

When it is determined that a given mobile home is an appropriate candidate for roof cavity insulation, loose fill fiberglass insulation shall be installed to insure a complete and continuous thermal barrier up to appropriate R-values.

Procedure - Mobile Home Roof Insulation

- Perform a careful assessment to determine the best method of accessing the roof cavity. Interior or exterior access may be used as determined on site. Installers should consult with their Building Analyst as well as the home's resident to determine the best means of access.

- If an exterior access method is chosen, care shall be taken to put minimal stress on building components during installation. Careful and permanent closure of access openings shall be accomplished so as to avoid any future water entry. The same size or larger screws must be utilized to re-secure roofing material and high performance, waterproof sealants must be used.
- If an interior access method is chosen, care shall be taken to limit, contain and remove any debris created during the installation and to return the interior finish to an acceptable condition.

STANDARD - WALLS

When it is determined that a given mobile home is an appropriate candidate for wall insulation, fiberglass loose fill or batt insulation shall be installed to insure a complete and continuous thermal barrier.

Procedure - Mobile Home Wall Insulation

- Access to insulate mobile home walls shall be from the exterior.
- There are two accepted methods for insulating mobile home walls. Blowing loose fill fiberglass through a wall tube fed into each cavity individually is one method and sliding fiberglass batts upward into the cavity is the other. Only full width (16" o.c.) wall cavities are appropriate for the batt sliding method.
- Installers must proceed with caution in order the avoid damage to interior wall materials (very often paneling), to electrical system components (wires, switches and receptacles, wall fixtures), and plumbing pipes.
- Siding must be re-secured after insulating using the same or larger screws as original.

WATER HEATER AND WATER PIPE INSULATION

STANDARD - WATER HEATER AND WATER PIPE INSULATION

Adding insulation to water heaters as a General Heat Waste measure is recommended when the existing water heater tank is insulated with fiberglass. When the existing water heater is insulated with injected foam insulation, additional insulation added to the outside of the tank is seldom beneficial. Water pipe insulation, especially in unconditioned areas, is recommended for the first 6' of both hot and cold water pipes.

Procedure - Water Heater Insulation

- Lower water temperature to 120 degrees
- Insulate tank with wrap around jacket.
- For electric water heaters, insulate the top and side. Insulation must not cover electric element covers or electric service wiring
- For gas water heaters, insulate side only. Insulation must not cover gas valve or gas piping. Trim insulation jacket at least 3" back away from the gas valve, access panel to pilot light and burner assembly, and the bottom of the tank.
- Insulation must not cover the temperature & pressure relief valve, extension pipe or drain.
- Tape edges of jacket with vinyl tape and secure jacket in place with nylon ties

Procedure - Water Pipe Insulation

- Insulate at least the first 6' of cold and hot water pipes coming off the tank
- Secure insulation so as to not allow movement
- Provide 3" minimum clearance from draft hood and vent on gas heated tanks

Notes