BUILDING IN ALASKA

Special Considerations For Building In Alaska

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INTRODUCTION

Special considerations for building in Alaska are recommended that are normally not included in structures designed for milder climates in the Lower 48 states. Plans and publications will be developed as new construction techniques are developed in Arctic construction.

A. FOUNDATIONS

1. Consult with an architect, engineer or contractor before building on soils subject to permafrost. This includes most of Interior Alaska and areas west and north of the Alaska range.
2. Enclosed crawl spaces or basements should not be constructed in soils subject to permafrost. Wood posts, mud sills or engineered foundations with open crawl spaces are suggested in permafrost soil.
3. In areas where masonry or concrete foundations are used, reinforce against seismic action in accordance with local or state codes. Reinforce masonry chimneys against earthquakes also. Other materials than masonry should be utilized for chimneys.
4. Consult with your local insurance agent and borough engineer before building in areas subject to flooding.
5. Foundations should be closed in and the building heated to avoid excessive heaving and settlement of footings during the winter.
6. All masonry and concrete foundations should be properly reinforced to minimize cracking due to heaving and settling of frozen ground.
7. Foundation Insulation
   a. A below-grade thermal envelope wall should be insulated to the minimum R-value shown in Table 1.
   b. A required R-value for crawl space wall insulation should be maintained for the full height of the wall.
   c. Exterior insulation may extend in a horizontal or diagonal manner out from a wall provided the length of insulation meets or exceeds that which would be placed in a vertical manner.
   d. An insulation material should have appropriate weather resistant properties for the intended use and should be applied as recommended by the insulation manufacturer.

B. FLOORS

1. In permafrost areas, floors should be constructed over open crawl spaces and insulated to minimize permafrost melting and to avoid uneven settling of the building.
2. The surface temperature of the floor is of particular concern in Arctic climates, since this is where we work, play and relax during our waking hours. The closer the floor surface temperature approaches room ambient temperature, the greater the comfort level.
3. A cold floor results in discomfort from direct radiation, stratification of cold air near the floor and warm air near the ceiling.
4. Floor insulation:
   a. A thermal envelope floor should be insulated to the minimum R-value shown in Table 1.
   b. A rim joist area of a thermal envelope floor should be insulated to the same requirement as given for an envelope floor.

c. A rim joist area of a non-thermal envelope floor (such as where a crawl space wall is insulated but the floor is not, or a second story floor) should be insulated to the same requirement as given for an Above-Grade or Below-Grade envelope wall, as appropriate.

SLAB-ON-GRADE FLOORS

a. A concrete slab-on-grade floor of a conditioned space or enclosed semiconditioned space should be insulated to the minimum R-value shown in Table 1.
b. An insulation material should have appropriate weather-resistant properties for below-grade application and should be applied as recommended by the manufacturer. Insulation damaged during construction should be replaced.
c. Insulation for a thickened edge or grade beam concrete slab floor should extend downward from the top of the slab to the bottom of the footing, then horizontally beneath the footing for its full width. Alternatively, insulation may extend downward from the top of the slab to the bottom of the footing, then diagonally out from the footing for a minimum horizontal distance of 18 inches.
d. Horizontally placed insulation under the perimeter of a basement concrete slab floor should be continuous around the entire perimeter of the slab and should be a minimum of 24 inches wide. Additionally, a thermal break should be provided between the foundation wall and the slab edge.
e. Permafrost areas require engineering analysis for proper application of insulation in contact with the ground. Improper application can result in ground thawing and cause severe damage to the structure.

5. An uninsulated concrete slab on-grade floor is not recommended for the main living area, as ground temperatures in Alaska are near 33°F. If used as the living area, the entire floor should be insulated with at least two inches of rigid foam plastic insulation. Perimeter insulation is not adequate for Alaska.
6. A polyethylene vapor barrier should be placed under all concrete floors poured on grade, or laid on the ground of closed crawl spaces, to minimize the migration and evaporation of excessive moisture from the soil.

C. WALLS

1. Wall insulation.
   Above-Grade Walls:
   An above-grade thermal envelope wall should be insulated to the min-imum R-value shown in Table 1. This includes the floor rim joist area.
2. A polyethylene vapor barrier should be placed on the interior faces of the studs directly over the insulation (warm side). Be careful to seal all openings made to accommodate plumbing vent stacks, chimneys, electrical wiring, etc.

3. The vapor barrier should be installed on the ceiling first, before any interior partitions are installed. Place the wall vapor barrier on the inside (warm side) on ceiling lap.
4. Wherever possible, it is recommended that no electrical wiring be installed in the ceiling except as outlined in the section on ELECTRICAL WIRING.*

D. CEILING

1. Ceiling insulation.
   A thermal envelope ceiling should be insulated to the minimum R-value shown in Table 1.
2. To minimize condensation stains on the ceiling and glaciering on eaves and valleys, the roof cavity must be kept cool and free of moisture by combining adequate vapor barrier, insulation and ventilation. (see CES Publication HCM-00559, *Design of Roofs for Northern Residential Construction.*
3. A polyethylene vapor barrier should be placed on interior surfaces of the ceiling directly under the insulation, prior to erecting partitions. Leave 8 to 12 inches overhang on the walls.
4. Be careful to seal all openings in the vapor barrier that may be caused by installing plumbing, electrical outlets, chimneys, etc.
5. The roof cavity must be ventilated by a combination of 2-inch continuous slots at both eaves and louvres at the gable.
6. If the supporting beam of a flat roof must be recessed into the ceiling, then a cricket must be constructed in the roof deck over the beam to assure ade-quate eave-to-eave ventilation. All effort should be made to avoid flat roofs.
7. Framing of scuttle openings or stairways into uninsulated attics should be avoided as it will eventually lead to condensation and frosting problems.
8. Openings into a cold attic should be provided through the gable wall from the outside.
9. If an attic must be accessible from the interior of the house for storage purposes, then it should be adequately insulated, vapor proofed, ventilated and heated to avoid condensation and frosting problems.
10. The use of thick insulation for the ceiling, necessitates special precautions to ensure adequate insulation at the eaves of gable roofs.
11. The trusses may be cantilevered so that they extend over the wall 18 to 24 inches on both sides. This allows 12 to 18 inches between the roof deck and the wall plate, providing 9 to 12 inches of clear space over the top for insulating the roof cavity.
12. Lumber sizes of conventional rafters may be increased to provide sufficient ventilation space over the insulation at the eaves. The rafters may also be raised up on a special header, notched into the ceiling joists, instead of setting the rafter onto the wall plate.

* *Building Energy Efficiency Standard*. State of Alaska Department of Community and Regional Affairs, September 1, 1991.

13. Do not taper the insulation at the eaves or pull the insulation back from the wall plate, as this increases the heat conduction through the plate, joists and rafters. Condensation and staining of interior finished surfaces may occur adjacent to the header and under the ceiling framing members.
14. Whenever possible, it is recommended that the installation of concealed wiring be avoided in ceilings of cold roof cavities. Refer to the section on ELECTRICAL WIRING* for alternative suggestions.

E. INSULATION

The Prescriptive Method establishes minimum thermal envelope insulation requirements for buildings. Exceeding these minimums is encouraged.

The Prescriptive Method does not require extensive calculations. It is the least flexible of the four possible compliance methods. This method should not be used to trade-off an R-value requirement between a different thermal envelope assembly or different element of the same assembly. For example, more insulation in the ceiling does not decrease the required insulation in the wall.

The Prescriptive Method does not dictate specific building methods or materials. Any method of constructing a building may be used provided clear compliance with the minimum insulation requirements is shown. For example, to meet a mini-mum R-18 wall insulation requirement, R-19 fiberglass batt in a 2x6 framed wall may be used, or R-13 fiberglass batt in a 2x4 framed wall with R-5 rigid insulation over the framing, or R-18 urethane foamed-in-place between 2x4 framing.

When using the Prescriptive Method as the means of compliance for the Alaska State Thermal Efficiency Standards, all mandatory measures given in Chapter 2 of the *Building Energy Efficiency Standard* should also be accomplished.*

Insulation Minimums

R-value minimums given in this chapter are for insulation installed between or over structural members. Only the insulation R-value is counted. R-value for an air film or a material such as sheetrock, paneling, plywood, siding, or earth backfill, for example, should not be included.

R-value minimums refer to the **installed** R-value. Compression of some insulating products results in a lower R-value. For example, placing a standard R-30 batt into a 2x8 wall compresses the batt from 9 inches down to 7-¼ inches. This results in a decreased R-value from the listed R-30 down to approximately R-26. Table 2 shows nominal examples of resultant R-values when fiberglass batts are compressed.

* *Building Energy Efficiency Standard*. State of Alaska Department of Community and Regional Affairs, September 1, 1991.

TABLE 1
Thermal Envelope R-value Requirements

This table lists minimum thermal envelope insulation requirements for buildings. Any method of constructing a building's thermal envelope may be used provided clear compliance with the listed R-values is shown and is acceptable to approving officials. R-value minimums refer to the installed R-value which may be different from the listed product R-value. Higher R-values may be used if desired.

CAUTION: Permafrost areas require engineering analysis for proper application of insulation in contact with the ground.

Region Number	Region Name	Heating Fuel	Thermal Envelope R-Value Requirements							
			Ceiling	Above grade Wall	Floor	Below grade Wall	Slab Floor		Window	Door[1]
							Base-ment	On-Grade		
1	Southeast	All Fuels	38	21	30	15	10	15	3.0	2.5,7
2	Southcentral	Natural Gas	38	18	19	10	10	10	3.0	2.5,7
2	Southcentral, Aleutian, Kodiak	All Fuels other than natural gas	38	25	30	15	10	15	3.0	2.5,7
3	Interior, Southwest	All Fuels	38	25	38	19	10	15	3.0	7
4	Northwest	All Fuels	38	30	38	19	10	15	3.0	7
5	Arctic Slope	All Fuels	52	35	43	—	—	—	3.0	7

Note:
1. Not more than one exterior door in a residential building in Region 1 or 2 may have an R-value less than 7, but not less than 2.5.

TABLE 2
R-value and Thickness

Example of resultant R-values when fiberglass batt insulation is compressed into a confined space such as in wall stud or floor joist spaces. Product thickness and density differ among manufacturers and therefore resultant R-values also differ slightly.

Nominal Lumber Size	Actual Width	Initial R-value and thickness					
		R-38 12	R-30 9-½	R-22 6-¾	R-19 6-⅛	R-13 3-⅝	R-11 3-½
		Installed R-value at final thickness					
2" x 12"	11-¼"	37					
2" x 10"	9-¼"	32	30				
2"x 8"	7-¼"	27	26				
2" x 6"	5-½"		21	20	18		
2" x 4"	3-½"		14	13	13		
2" x 3"	2-½"					10	9
2" x 2"	1-½"					6	6

F. VAPOR BARRIER

1. A 6-mil polyethylene vapor barrier should be installed over all interior surfaces directly over the insulation prior to installation of partitions and interior finishes.
2. Refer to sections on FLOORS, WALLS AND CEILING for further details. Also refer to section on INSPECTION.

G. INSPECTION

It is recommended that no interior finished floor, wall or roof covering be installed until the insulation, vapor barrier, concealed plumbing and electrical wiring have been approved by the prospective homeowner or his authorized representative, consisting of either the building inspector, the finance agency and/or the architect.

H. VENTILATION

1. Ventilation fans should be installed in the kitchen, bathroom and laundry room. Do not vent fans directly into the roof or crawl space cavities.
2. If electricity is not available, a simple exhaust duct installed over the cook stove and vented through the roof to the outdoors should be provided. The air flow may be controlled by an adjustable damper.
3. Automatic clothes dryers whether electric or gas heated, should be vented outdoors by an approved vent pipe.
4. Mechanical ventilation is now the norm for new energy efficient housing in Alaska. See CES Publication HCM-01551, *Ventilation in Small Houses*.

I. WINDOWS

1. Windows for Alaskan homes should be constructed with wood or vinyl frames and sash and fitted with double sealed glass. Single glass may be glazed into the sash and fitted on the outside of the sash with a second removable glass pane. Modern energy efficient windows should be used whenever now construction is undertaken.
2. Storm-type windows fitted onto the window frames are not suitable for prolonged periods of subzero temperatures, as migration of moisture around weather-stripping condenses out onto the storm window and will obscure the glass with heavy frost. Once the frost has formed, it cannot be removed except by warming the storm windows by special insulated storm shutters.
3. To eliminate condensation problems along the edge (rim) of double insulating glass panes, a third pane of glass may be installed over the outside of the wood sash.
4. Refer to CES Publication HCM-04458, *Windows* .

5. Window Insulation
   a. An exterior window RO-value (overall R-value, including the frame) should not be less than specified in Table 1.
   b. A sliding glass door should be considered a window for the purpose of determining total allowable glazed area percentage (see Paragraph "c" below) and required R-value.
   c. Total window and sliding glass door area should not exceed 15 percent of the total gross above-grade thermal envelope wall area. If more than 15 percent window area is desired. See Chapter 4, 5, or 6, which should be used as the method of showing compliance with the overall energy efficiency of a building.*
   d. A window for special architectural or decorative purpose may have an R-value less than required by Table 1 provided:
      1) it is double glazed or more, and
      2) total decorative window area does not exceed 5 percent of the allowable window area specified in Paragraph "c" up to a maximum of 16 square feet.

J. DOORS

1. Storm doors and closed entries are desirable for arctic climates.
2. Metal doors with an insulated core and special thermal separators between the inside and the outside shells are excellent for arctic conditions, Except adjustable door frames are necessary to compensate for the continual heaving and settling of the active frost layer of the soils of interior Alaska.
3. Insulation
   a. An exterior door RO-value should not be less than specified in Table 2.
   b. Door glazing should be minimum double glazed with a ½-inch minimum air space.
   c. A sliding glass door, should be considered as a window for the purpose of determining R-value and area requirements. See Section on WINDOWS.

K. STORAGE SPACES

1. The placement of closets, kitchen cabinets, and other built-in storages on exterior walls should be avoided wherever possible to minimize condensation and frosting problems. This includes storage placed under the eaves of 1-½ story houses.
2. If storage space must be placed along exterior walls, provide adequate ventilation with louvred doors, drapes or other openings. A section of baseboard radiation placed on exterior walls would be a positive aid in maintaining the storage above the dew-point temperature.

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* *Building Energy Efficiency Standard*. State of Alaska Department of Community and Regional Affairs, September 1, 1991.

3. Avoid storing boxes, magazines and clothing tightly against exterior walls. Install 1" x 1" wood slats on 2" centers on the wall and floor to facilitate natural ventilation.

L. ELECTRICAL WIRING

1. In order to avoid condensation problems caused by inadvertent puncturing of the polyethylene vapor barrier by present concealed wiring techniques, it is suggested that either the wiring be run in exposed raceways or concealed in special chases as outlined below.
2. Exposed Wiring.
   Electrical circuits and outlets may be run with exposed “Wiremold” raceways with surface outlets or “Electrostrip” narrow feed-in cable with adjustable convenience outlets. These circuits may be fed from wiring and outlets concealed in adjacent interior partitions.
3. Concealed Wiring.
   a) The wiring may be laid in chases constructed from 2" x 3" nailers that are installed perpendicular to the studs or rafters after the insulation and vapor barrier have been properly placed and sealed.
   b) Where circuits must pass through obstructions, such as at the sole or plate, the nailers should be cut out and the cable protected from possible shorting of nails with 1" x 1" x ⅛" angle iron caps.
   c) The added cost of the nailer may be partially offset by eliminating the need to bore holes and thread the cables through the framing members.
   d) The short construction season of Arctic climates necessitates enclosing the building as soon as possible. Installing temporary heat without having all of the concealed plumbing and wiring built into the wall before the insulation and vapor barrier can be properly installed and inspected can result in major condensation problems. Refer to sections on VAPOR BARRIER, INSPECTION, and UNVENTED SPACE HEATERS.
   e) A 6-mil vapor should be used when nailers are provided as electrical chases.

M. UNVENTED SPACE HEATERS

1. Do not operate unvented fuel oil or bottled gas space heaters as temporary heat until the insulation and vapor barrier have been fully installed and adequately sealed.
2. If the vapor barrier is not sealed, the invisible water vapor produced by the space heater will condense out in the insulation and other cold surfaces. The moisture may freeze and damage siding. During the spring thaw, melting of the ice will stain exterior and interior finishes.
3. Unvented combustion space heaters should never be used as heating sources in any living space.

N. CHIMNEY

1. The chimney must be tightly sealed at the ceiling penetration to minimize migrating moisture and infiltrating excess heat into the roof cavity.
2. Gas furnaces should be provided with an approved masonry chimney or **all-fuel** pre-fabricated metal chimney.
3. Lightweight uninsulated metal gas vents can result in excess heat formation in a poorly vented roof cavity, particularly a gable roof, resulting in excessive glaciering at the eaves.

O. HEATING

1. The packaged precut or panel home should include a complete set of plans and a tabulation of the heat losses of each room, the recommended size heating plant, the size of baseboard radiation, size of hotwater heating pipes, electric heating conductors, sizes of hot air and return registers, size of ducts, and an estimate of annual fuel or energy requirements for Alaskan climates.
2. All hot water heating plans should provide for approved zone control valves and balancing cocks for each heating zone.
3. All hot air heating plans should provide for adjustable dampers on each branch duct and adjustable blower pulleys for proper balancing of the air flow to each register.
4. If the prime contractor or subcontractor does not maintain service personnel in Alaska during the winter season, then a local heating contractor should be designated to correct any normal deficiencies in the heating system, such as excess noise, improper balancing, excessive fuel consumption, etc.

P. SEPTIC TANK

All septic and alternative on-site waste disposal systems are subject to Department of Environmental Conservation regulations and should be installed by a D.E.C. certified installer. Aerobic compost systems exist that are a low water use, very beneficial alternative to standard septic tank and leach field systems.

OTHER COOPERATIVE EXTENSION SERVICE PUBLICATIONS OF INTEREST

HCM-00559 *Attics and Roofs for Northern Residential Construction*
HCM-01551 *Ventilation in Small Houses*
HCM-01556 *Small House Construction on Bogs and Muskeg*
HCM-04458 *Windows*