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SECTION 07211 - GLASS FIBER BATT BUILDING INSULATION

PART 1 - GENERAL

1.1 DEFINITIONS

A. Rated R-value of insulation: The thermal resistance of insulation as specified by the manufacturer in units of hr. sq. ft. °F/Btu at a mean temperature of 75 °F. The R-value refers to the thermal resistance of the insulation alone and does not include the thermal resistance of other building materials or air films.

1.2 SYSTEM DESCRIPTION

A. [Standard] [Bi-component] glass fiber batt insulation installed in [wall cavity] [ceiling cavity] [roof] to meet the required thermal performance. (*Note 1.4).*

1.3 SUBMITTALS

A. SPECIAL ENVIRONMENTAL REQUIREMENTS: Submit the following in accordance with the requirements of Section 01350:
   1. Resource efficient product data: Submit required information concerning project recyclability (packaging), product recycled content, and product recyclability.
   2. Environmental issues certification: Submit written certification stating that the products installed are essentially the same as those defined by the Project requirements (specifications, submittals, and/or test data) in terms of recycled content, recyclability and indoor air quality.
   3. Indoor Air Quality: Submit Material Safety Data Sheets (MSDS) and emission test data.

1.4 QUALITY ASSURANCE

A. Refer to Section 01350 – Special Environmental Requirements.

1.5 DELIVERY, STORAGE AND HANDLING

A. Refer to Section 01350 – Special Environmental Requirements.

B. Refer to Section 01565 – Site Waste Management Program.

1.6 WARRANTY

A. Insulation manufacturer shall warrant that the actual thermal performance of the specified product when properly installed at specified thickness and sealed against air and water vapor infiltration for ____ years.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Description: [Standard glass fiber] [Bi-component glass fiber] batt insulation. *(Note 1.3).*

B. Performance Requirements:
   1. Walls (above grade): Insulation shall have a minimum rated R-value of ____ hr. sq. ft. °F/Btu. *(Note 1.4).*

2. Roof: Insulation shall have a minimum rated R-value of ____ hr. sq. ft. °F/Btu. *(Note 1.4).*

C. Recycled content: Minimum 30% post consumer, 20% post-industrial (50% total) for glass fiber core. *(Note 1.5).*

D. Product shall emit no formaldehyde when tested per § 01350. *(Note 1.6).*

E. Provide encapsulated product where glass fiber is used.

2.2 ACCESSORIES

A. Insulation supports: Corrugated cardboard for overhead installation: 100% recycled content.

2.3 SOURCE QUALITY CONTROL

A. Recyclability: Project goal is to provide products that are [100] percent recyclable.

PART 3 - EXECUTION

3.1 ACCEPTABLE INSTALLERS

A. Installer shall recycle scrap insulation.

3.2 PREPARATION *(NOTE 1.7).*

A. Construction debris shall be removed from spaces to be insulated. *(Note 1.8)*

B. Leaks in the walls, floors, or ceiling shall be sealed with sealant to stop air infiltration.

C. Ensure that edges around windows and doors are adequately sealed to prevent air infiltration.

D. Gaps around pipes and ducts penetrating walls or ceiling shall be sealed.

3.3 INSTALLATION *(SEE NOTE 1.9)*

A. Install insulation that is dry and free of damage. *(Note 1.9a).*

B. All building insulation shall be protected from high humidity conditions. In cases where glass fiber will dry naturally and regain its original R-value, insulation shall be allowed to dry thoroughly. Under conditions where the insulation will not dry thoroughly insulation shall be replaced. *(Note 1.9a).*

C. Insulation shall be isolated from interior space by installing a continuous layer of impervious material (air-barrier) between the insulation and the living space. *(Note 1.9b).*

D. Unfaced building insulation shall not be installed in an exposed location/surface where it will be subject to human contact. *(Note 1.9b).*

E. If new material is being added to insulation already in place, batts with no vapor retarders attached to it shall be used. In case such a product is unavailable the vapor retarder facing between layers of insulation shall be removed. *(See Note 1.9c).*

F. Insulation shall be installed snugly between framing members, leaving no gaps between framing members. *(Note 1.9d).*

G. Insulation shall be cut to butt-fit around obstructions and penetrations, or the insulation shall be cut to the middle of the batt's thickness and one flap shall be

under the wire/pipe and the other over the wire/pipe. Insulation shall not be compressed to fit behind pipes or wires. *(Note 1.9e).*

H. Bridging or cross bracing of ceiling or floor joists shall be insulated by splitting a batt vertically at the center and packing one half into the lower opening and the other half into the upper opening.

I. Junction boxes for wall switches and convenience outlets at outside walls shall be insulated between the rear of the box and the sheathing. Insulation shall be placed behind the junction box and if necessary, insulation shall be cut to fit snugly around it.

J. Insulation shall be placed between the piping in exterior walls and the exterior wall sheathing. Sidewalls where plumbing fixtures are to be placed shall be insulated before the fixtures are installed.

K. Insulation shall not be installed on a suspended ceiling with removable ceiling panels.

L. Wood-framed wall:

1. For cold or mild climates: The vapor retarder shall be installed on the surface that is in contact with the interior space. *(Note 1.9f).*
2. For hot and humid climates: The vapor retarder should be installed facing the exterior. *(Note 1.9f).*
3. For glass fiber insulation with facing, flanges shall be stapled either to the faces or sides of the studs. Flanges shall be pulled taut and stapled such that there are no gaps between the stapling surface and the flanges through the entire length of the insulation. The flange of the faced insulation placed in the next cavity shall overlap the previously stapled flange.
4. Unfaced rigid fit insulation shall be pressure fitted between studs.
5. Additional strips of insulation shall be cut and installed to fill all gaps around window and doorframes, without compressing the insulation.
6. Pieces of insulation shall be installed (without compressing the insulation) in small spaces between studs at the corners of buildings and at intersections of partitions and sidewalls before sheathing is applied.
7. Non-standard-width framed spaces shall be insulated by cutting the insulation and facing about an inch wider than the space to be filled. The uncut flange shall be stapled as usual. The facing on the cut side shall be pulled to the other stud and stapled through the vapor retarder to the stud.

M. Metal-framed wall:

1. For cold or mild climates: The vapor retarder shall be installed on the surface that is in contact with the interior space. *(Note 1.9f).*
2. For hot and humid climates: The vapor retarder should be installed facing the exterior. *(Note 1.9f).*
3. A single batt whose length is equivalent to the distance between the studs should be used in sidewalls. When more than one batt is used, pieces shall be snugly butted.
4. Glass fiber batt insulation shall be friction fitted into stud cavities. Stapling flanges shall be left folded when faced insulation is used. The interior wall shall be applied after the friction fit installation to complete the installation procedure.

(*Note 1.9g).*

5. A layer of insulation sheathing shall be installed, in addition to batt insulation. *(Note 1.9h).* [Optional-Edit as per project]
6. Steel frames shall be wrapped with rigid foam insulation caps. *(Note 1.9h).* [Optional-Edit as per project].
7. Additional strips of insulation shall be cut and installed to fill all gaps around window and door frames.
8. Pieces of insulation shall be installed in small spaces between studs at the corners of buildings and at intersections of partitions and sidewalls before sheathing is applied.

N. Wood-framed ceiling:

1. Faced insulation shall be placed between joists with the vapor retarder facing down. If insulation is installed before ceiling finish flanges shall be stapled to bottom faces or sides of joists.
2. Non-standard-width framed spaces shall be insulated by cutting the insulation and facing about an inch wider than the space to be filled. The uncut flange shall be stapled as usual. The facing on the cut side shall be pulled to the other stud and stapled through the vapor retarder to the stud.
3. Install unfaced batt insulation in warm, humid climates. [Optional – Edit as per location of project].
4. If the existing insulation is near or above the top of the joists, the new batts shall be placed perpendicular to the old ones. *(Note 1.9i).*
5. All deep drops and interior wall cavities shall be covered by an impervious layer to keep insulation in place and stop air movement.

O. Floor Joists:

1. Faced insulation shall be used with the vapor retarder facing up.
2. Where the insulation is less than the thickness of the joists and the method of installation does not hold the insulation up against the sub flooring, the headers or band joists at outside walls shall also be insulated. *(Note 1.9j).*

P. Cathedral Ceilings:

1. A ventilation space of at least [one inch] shall be left between the insulation and the roof.
2. Prior to installation, a ventilation baffle shall be installed at the eave of every joist if high-density insulation that can maintain the required ventilation space is used. Alternately, ventilation baffles shall be installed along the entire run of each rafter cavity. *(Note 1.9k).*
3. Faced insulation shall be installed with vapor retarder facing down, and stapled between the rafters. Staples shall not be secured to the inside face of the rafter. The flange of the faced insulation placed in the next cavity shall overlap the previously stapled flange.
4. Non-standard-width framed spaces shall be insulated by cutting the insulation and facing about an inch wider than the space to be filled. The uncut flange shall be stapled as usual. The facing on the cut side shall be pulled to the other stud and stapled through the vapor retarder to the stud.
5. If unfaced insulation is used in cathedral ceilings, a separate vapor retarder shall be installed. When vents at both eaves and ridge are not provided, a high-

performance vapor retarder, such as polyethylene, shall be used in northern locations. (Polyethylene can be used with either faced or unfaced insulation.)

Q. Metal-framed ceiling:
   1. Unfaced glass fiber batt insulation shall be friction fitted into stud cavities. Stapling flanges shall be left folded when faced insulation is used. The ceiling shall be applied to complete the friction fit installation.
   2. Ventilation and vapor retarder requirements shall be the same as with wood framing.

R. Underside of framed roof
   1. Faced insulation shall be installed with the vapor retarder facing down in colder climates. *(Note 1.9f).*
   2. Ventilation and vapor retarder requirements are the same as with wood framing.

S. Metal deck
   1. Seams between batts shall be sealed to complete the vapor barrier.

3.4 FIELD QUALITY CONTROL

A. Commissioning agent shall be notified reasonably ahead of time to allow for inspection and verify that the approved insulation material is used and installed as per specifications, after the preparation stage, and prior to covering insulation with interior finish. *(Note 1.10).*

3.5 CLEANING

A. Final cleaning shall be as described in section 01350.

B. Remove and recycle excess materials as required by the construction waste management program, section 01565.

END OF SECTION

NOTES

SECTION 07211 - GLASS FIBER BATT BUILDING INSULATION – NOTES

JUSTIFICATION

1.1 Insulation reduces energy consumption in a building.

1.2 Glass fiber is extremely durable and can outlast the life of the building. It can be reused or recycled when installed properly. The inorganic nature of the substance does not promote the growth of bacteria, mold, fungi and other organisms that can cause indoor air quality concerns.

1.3 Bi-component glass fiber is less friable than standard glass fiber. Less friable fibers of bi-component glass fiber lower possibility of inhaling loose fibers or skin irritation during the installation process. It is also free of added color or binder. Choosing products free of formaldehyde, reduces indoor air quality concerns.

1.4 R-value specified here should meet or exceed the R-value specified in Table 1-H or Table 1-I of 2001 Energy Commission Efficiency Standards For Residential And Nonresidential Buildings (adopted pursuant to Assembly Bill 970, Statutes of 2000).

1.5 While the production process is energy intensive, high-recycled content and associated energy benefits can offset the environmental impact during the production process. Glass fiber that recycles post-consumer material uses less energy in the manufacturing process, than one that does not use any. Recycling insulation also removes a significant amount of material from the solid waste stream, and helps in reducing toxicity in the land and relieves pressure from urban landfills. Glass fiber batts can be reused and recycled into loose-fill insulation using “The Big Green Machine”.

1.6 Formaldehyde-free insulation is a critical factor in improving indoor air quality.

1.7 Meticulous preparation prior to installation to seal all visible gaps, potential leakages or openings in the surfaces where insulation will be installed reduces air infiltration. Air infiltration can introduce moisture and reduce thermal performance of glass fiber insulation.

1.8 Ensure that surfaces are clean before installing insulation since presence of debris on the insulation affects thermal performance.

1.9 Proper installation is the key to getting the rated performance of glass fiber batts and desirable indoor air quality. Proper installation ensures durability and enables reuse of the product. Scraps of glass fiber batt insulation can be recycled to produce loose-fill insulation, when installed as per specifications.

a. Moisture penetration can cause structural damage and adversely affect the thermal performance of glass fiber insulation. Installing dry insulation and following the specified installation technique prevent moisture penetration.

b. Isolating the insulation from living areas and supply air paths ensures that glass fibers (a probable carcinogen) stay out of the living area air-stream.

c. When more than one layer of insulation is installed, having more than one layer of vapor retarder would trap any existing moisture between the two layers of vapor retarder and prevent it from drying out. As discussed

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earlier, this would reduce the intended thermal performance of the insulation.

d. Air gaps left in insulated cavities reduce thermal performance of insulation.

e. Incorrect installation procedure, such as compressing the batt and continuous contact to surfaces with temperatures below freezing, reduces overall R-value.

f. Check local code for appropriate orientation or use of vapor barrier. The orientation of the vapor retarder is critical to avoid moisture deposition.

g. Ensure that batts are constrained by studs at their edges and by wall facings front and rear, since air gaps adversely affect R-Value.

h. For highly conductive framing systems installing a layer of insulating sheathing minimizes the effect of thermal bridging. If it is not possible to install a layer of sheathing, wrapping insulation, typically rigid foam, around the steel frame can also reduce the effect of thermal bridging and increase the depth of the cavity for installing insulation (making it possible to install a thicker batt with a higher R-value).

i. Placing a new layer of batt insulation perpendicular to the old one on top of the joists in wood-framed ceiling covers the tops of the joists and reduces heat loss or gain through the frame.

j. The air space between the top of the insulation and the sub-floor will allow heat to be lost at outside walls, unless the headers/band joists are insulated as well.

k. Check local code for ventilation space requirement.

1.10 Commissioning agent should verify the following by doing spot checks at various locations in the ceiling and walls:

a. Ensure that insulation is isolated from living areas to prior to installing insulation by checking wall, floor and ceiling surfaces, for potential leakages before insulation is installed. Check to see if tops of interior wall cavities, areas above staircases and dropped ceilings, are adequately sealed by wrapping a plastic sheet that will effectively prevent insulation from dropping/sagging into these cavities. Check to see that edges around windows, doors and gaps around pipes and ducts are adequately sealed, before insulation is installed.

b. Metal accessories shall be inspected for signs of corrosion prior to installing insulation, and replaced if necessary.

c. Do spot checks to ensure that insulation is not damp or damaged and meets the specified R-value.

d. Lift insulation at a few spots to ensure that there is not a significant amount of debris on the insulated surface or the insulation.

e. Verify that insulation is properly isolated from living areas by using an impervious barrier and unfaced insulation is not installed in areas where it will be easily subject to human contact.

f. Check to see that vapor retarder has been removed from additional layer

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of insulation when more than one layer is installed.

g. When installed between framed-members, insulation shall be inspected prior to covering to verify if installation meets the standards as specified in the installation procedure.
   1) Insulation is not compressed behind pipes and other penetrations, packed around window, split and wrapped around joists and pipes etc.
   2) There is no air gap between pieces of batt insulation when more than one batt is used between framing members.
   3) Faced insulation is stapled as per specifications (without gaps, on the specified side of the joists etc.)
   4) Do spot checks to see that insulation is installed in corners and intersections of exterior walls.

h. Do spot check to verify that vapor-retarder faces specified direction.

i. Inspect cathedral ceiling prior to installing insulation to verify installation of ventilation baffles as per specifications.

APPLICATION

2.1 Wall, ceiling and floor cavity insulation.

2.2 Continuous insulation under roof or floor.

2.3 Wood or metal frame.

COST IMPACT

3.1 Detailed installation practices could cost more.

3.2 Installation cost of less than $0.30 to $0.50 per square foot of R-19 installed.

EXAMPLE PRODUCTS AND MANUFACTURERS

4.1 Glass fiber batt

a. Miraflex (non-offgassing, less toxic glass fiber insulating material with 30% post-consumer recycled content) and PinkPlus by Owens Corning. http:// www.owenscorning.com

b. CertainTeed, EasyHandler (fiber batt insulation with polypropylene wrap) by CertainTeed Inc. http:// www.certainteed.com

c. Grid shield Rx by Schuller Inc.

d. "Comfort Therm", "Thermal-SHIELD" and "Goldline" (glass fiber batt insulation with 25% recycled glass) by John Manville, http:// www.jm.com

4.2 Accessories

a. Snap-Cap by U.S. Building Technology. This technology optimizes the use of rigid insulating foam, by placing it on the framing members only (the studs, the plates, and the headers). The Snap-Cap product employs a friction-fit insulation design that snaps onto the framing members during the normal construction process. The rigid foam insulates the framing and deepens the wall cavity, which improves the overall thermal performance of the wall by reducing the effect of thermal bridging and making it

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possible to install a thicker batt than would be possible with the existing frame size.

b. Snap-Cap can be installed on the exterior, interior, or both surfaces of the wall assembly. USBT and Snap-Cap are trademarks of the United States Building Technology Inc., 1 Rice Street, Suite #1, Natick, MA 01760, USA.

c. Raft-R-Mate® attic rafter vents by Owens Corning. RAFT-R-MATE® attic rafter vents create a space between each rafter for air to flow freely up the rafters and into the attic. Owens Corning RAFT-R-MATE Attic Rafter Vents are made of extruded polystyrene. http://www.owenscorning.com/around/ventilation/raftrmate_attic.asp

4.3 Recycling

Don Smith,
Big Green Marketing,
PO Box 510,Bend,
OR 97709,
503/383-0095.

REFERENCES FOR MORE INFORMATION

5.1 California Energy Commission. 2001 Energy Commission Efficiency Standards For Residential And Nonresidential Buildings (adopted pursuant to Assembly Bill 970, Statutes of 2000).

5.2 Demkin, J. A. 1997. Environmental Resource Guide. John Wiley and Sons. New York. (Environmental and indoor air quality issues during manufacture and installation of glass fiber insulation products).

5.3 Environmental Building News. Volume 3, Number 2. p 5. (Recycling fiberglass insulation scraps).

5.4 Wilson, A. 1995. Environmental Building News. Vol. 4. Number 1. p.1 & pp. 11-17 (Environmental and indoor air quality issues during manufacture and installation of insulation products).

5.5 Zaloudek, J. 1995. Environmental Building News. Vol. 4. Number 1. pp. 8-9. (Environmental and health-related benefits of Miraflex by Owens Corning).

5.6 EBN. 1997. Environmental Building News. Vol. 6. Number 9. p. 9. (Accessory for wrapping steel framing).

5.7 EBN. 1996. Environmental Building News. Vol. 5. Number 6. pp. 9 – 10. (Environmental and health-related benefits of Grid-SHIELD Rx by Schuller Inc. and CertainTeed by CertainTeed Corporation).

5.8 North American Insulation Manufacturer's Association. http://www.naima.org/ (Environmental and health-related benefits of glass fiber, scheduling, installation and applicable standards).

RELATED SPECIFICATION SECTIONS

6.1 07212 Mineral Wool Batt Building Insulation

6.2 07213 Cellulose Spray (Loose) Building Insulation

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6.3 07214 Glass Fiber Blown-in Building Insulation
6.4 07215 Mineral Wool Blown-in Building Insulation
6.5 07216 Cellulose Spray (Wall Cavity) Insulation
6.6 07217 Foam Board Building Insulation
6.7 07218 Radiant Barrier Building Insulation
6.8 07220 Roof and Deck Insulation
6.9 07240 Exterior Insulating Finish System (EIFS)
6.10 07300 Shingles, Roof Tiles and Roof Coverings
6.11 07500 Membrane Roofing
6.12 07610 Sheet Metal Roofing
6.13 07814 Cementitious Fireproofing

SECTION 07212 – MINERAL WOOL BATT BUILDING INSULATION

PART 1 - GENERAL

1.1 DEFINITIONS

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

1.2 SYSTEM DESCRIPTION

A. Mineral wool batt insulation installed in [wall cavity] [ceiling cavity] [roof] to meet the required thermal performance. *(Note 1.2)*.

1.3 SUBMITTALS

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

1.4 QUALITY ASSURANCE

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

1.5 DELIVERY, STORAGE AND HANDLING

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

1.6 WARRANTY

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

PART 2 - PRODUCTS

2.1 MATERIALS

A. Description: Mineral wool batt insulation.

B. Performance Requirements:

1. Walls (above grade): Insulation shall have a minimum rated R-value of ____ hr. sq. ft. °F/Btu. *(Note 1.2).*
2. Roof: Insulation shall have a minimum rated R-value of ____ hr. sq. ft. °F/Btu. *(Note 1.2).*

C. Recycled content: Minimum 75% post industrial for mineral wool core.

D. Product shall emit no formaldehyde when tested per § 01350.

2.2 ACCESSORIES

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

2.3 SOURCE QUALITY CONTROL

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

PART 3 - EXECUTION

3.1 ACCEPTABLE INSTALLERS

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

3.2 PREPARATION

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

3.3 INSTALLATION

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

3.4 FIELD QUALITY CONTROL

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

3.5 CLEANING

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

END OF SECTION

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SECTION 07212 – MINERAL WOOL BATT BUILDING INSULATION – NOTES

See also Section 07211 - Glass Fiber Batt Building Insulation.

JUSTIFICATION

1.1 Insulation reduces energy consumption in buildings. Mineral wool batts can be reused and recycled effectively. While the production process is energy intensive, its energy benefits can effectively offset the environmental impact during the production process. Mineral wool has a high-recycled content and removes waste from the solid waste stream.

1.2 R-value specified here should meet or exceed the R-value specified in Table 1-H or Table 1-I of 2001 Energy Commission Efficiency Standards For Residential And Nonresidential Buildings (adopted pursuant to Assembly Bill 970, Statutes of 2000).

APPLICABILITY

2.1 Wall, ceiling and floor cavity insulation

2.2 Continuous insulation under roof or floor.

2.3 Wood or metal frame.

COST IMPACT

3.1 Detailed installation practices may cost more.

3.2 Installation cost of less than $.50 per square foot of R-19 installed.

EXAMPLE PRODUCTS AND MANUFACTURERS

4.1 Mineral Wool insulation made from volcanic rock and recycled steel slag by Roxul, Inc.

REFERENCES FOR MORE INFORMATION

5.1 California Energy Commission. 2001 Energy Commission Efficiency Standards For Residential And Nonresidential Buildings (adopted pursuant to Assembly Bill 970, Statutes of 2000).

5.2 Demkin, J. A. 1997. Environmental Resource Guide. John Wiley and Sons. New York. (Environmental and indoor air quality issues during manufacture and installation of mineral wool insulation products).

5.3 Wilson, A. 1995. Environmental Building News. Vol. 4. Number 1. p.1 & pp. 11-17 (Environmental and indoor air quality issues during manufacture and installation of insulation products).

5.4 http://www.naima.org/ (Properties, applicable standards and installation)

RELATED SPECIFICATION SECTIONS

6.1 07211 Glass Fiber Batt Building Insulation

6.2 07213 Cellulose Spray (Loose) Building Insulation

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6.3 07214 Glass Fiber Blown-in Building Insulation
6.4 07215 Mineral Wool Blown-in Building Insulation
6.5 07216 Cellulose Spray (Wall Cavity) Insulation
6.6 07217 Foam Board Building Insulation
6.7 07218 Radiant Barrier Building Insulation
6.8 07220 Roof and Deck Insulation
6.9 07240 Exterior Insulating Finish System (EIFS)
6.10 07300 Shingles, Roof Tiles and Roof Coverings
6.11 07500 Membrane Roofing
6.12 07610 Sheet Metal Roofing
6.13 07814 Cementitious Fireproofing

SECTION 07213 – CELLULOSE SPRAY (LOOSE) BUILDING INSULATION

PART 1 - GENERAL

1.1 DEFINITIONS

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

1.2 SYSTEM DESCRIPTION

A. Cellulose loose-fill insulation installed in [wall cavity] [ceiling cavity] to meet the required thermal performance. *(Note 1.3)*.

1.3 SUBMITTALS

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

1.4 QUALITY ASSURANCE

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

1.5 DELIVERY, STORAGE AND HANDLING

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

1.6 WARRANTY

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

PART 2 - PRODUCTS

2.1 MATERIALS

A. Description: Cellulose loose-fill insulation complying with the performance requirements of ASTM C 739, "Industry Standard Loose-fill cellulose insulation for Thermal Insulation".

B. Use cellulose manufactured using the fiberization process. [Optional – Edit as per project] *(Note 1.2).*

C. Performance Requirements:

1. Walls (above grade): Insulation shall have a minimum rated R-value of ____ hr. sq. ft. °F/Btu. *(Note 1.3).*
2. Roof: Insulation shall have a minimum rated R-value of ____ hr. sq. ft. °F/Btu. *(Note 1.3).*

D. Recycled content: Minimum 75% post-consumer recycled content. *(Note 1.4).*

E. Product shall emit no VOCs. *(Note 1.5)*

2.2 SOURCE QUALITY CONTROL

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

PART 3 - EXECUTION

3.1 ACCEPTABLE INSTALLERS

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

3.2 PREPARATION *(NOTE 1.6).*

A. Construction debris shall be removed from spaces to be insulated.

B. Wood studs shall be examined for moisture content. They shall not exceed 19% moisture content at the time of installation.

C. Installer shall inspect external siding of existing building for peeling paint, mildew, fungi and other such indicators of moisture problems and rectify them.

D. Installer shall inspect the interior walls for weak spots that may not be able to withstand pressures during the filling operation, and shall reinforce them. Alternately, the installer shall use less pressure when filling such areas.

E. Installer shall check for holes in ceilings or sidewalls that would allow insulation to escape, and seal them.

F. Installer shall seal walls that go into basements or crawl spaces.

G. Installer shall inspect walls with alterations (such as built-in bookshelves and cabinets) for isolated cavities, and make separate entry holes for these cavities.

H. Installer shall not fill wall cavities that are used as air ducts for HVAC systems.

I. Installer shall place blocking around openings in heating or air-conditioning systems, in insulated areas, without restricting airflow.

J. Hard covers shall be placed over all deep drops and interior wall cavities to keep insulation in place and stop air-movement.

K. Small inaccessible openings shall be filled with pieces of batt insulation.

L. All potential gaps for air infiltration or leakage such as, missing electrical plates or loose fitting moldings, shall be replaced and or caulked from inside to prevent infiltration of cellulose dust into the living space through these leakages.

M. All voids around windows and doors shall be sealed with urethane foam or similar material to stop air infiltration. Expanding foams shall not be used around windows or doors.

N. All vertical plumbing and electrical penetrations shall be sealed through both top and bottom plates of all walls.

O. The open side of any wall between a heated and unheated area shall be covered by backer board to form a cavity for retaining loose fill material.

3.3 INSTALLATION *(NOTE 1.7)*

A. Dry and undamaged insulation shall be installed.

B. Installer shall comply with manufacturer’s coverage specifications. The bag count and the weight per square foot requirements of the coverage chart shall be adhered to. *(Note 1.8)*

C. The minimum thickness of the insulating layer shall be equal to the thickness as specified in the product label before settling has occurred. *(Note 1.8)*

D. The insulation shall be blown in the direction of the joists and not across them.

E. Insulation shall go underneath and on both sides of the obstruction such as cross bracing and wiring.

F. Wall or ceiling cavity shall be completely filled up with insulation.

G. Cold air returns or combustion air intakes for hot air furnaces shall not be blocked or insulation shall not be installed in a manner that would allow it to be drawn into the system.

H. Areas under any plywood platform or walks for HVAC equipment installation and access shall be pressure-filled with insulation, unless appropriate batt insulation has already been installed.

I. Rigid foam or batt insulation (that is equal to or exceeds the R-Value of the insulation on the ceiling) shall be permanently attached to the access panels and doors using adhesive or mechanical fastener.

J. Vapor retarder:

1. For cold or mild climates: The vapor retarder shall be installed on the wall that is in contact with the interior space. *(Note 1.9)*
2. For hot and humid climates: The vapor retarder should be installed on the wall that is in contact with the exterior. *(Note 1.9)*

3.4 FIELD QUALITY CONTROL

A. Commissioning agent shall be notified reasonably ahead of time to allow for inspection and verify that the approved insulation material is used and installed as per specifications after the preparation stage, and before the insulation is covered with interior finish. *(Note 1.10)*

3.5 CLEANING

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

END OF SECTION

NOTES

SECTION 07213 – CELLULOSE SPRAY (LOOSE) BUILDING INSULATION – NOTES

See also notes for Section 07211 - Glass Fiber Batt Building Insulation.

JUSTIFICATION

1.1 Insulating a building reduces heating and cooling loads. Cellulose products are less susceptible to depreciation in effective R-Value in extreme cold conditions and can be installed with maximum efficiency even in very cold climates (unlike glass fiber or mineral wool insulation products). High recycled content, low production energy and localized production (low transportation energy) makes cellulose the insulation product with the lowest embodied energy, and relatively low environmental impact.

1.2 The fiberization process produces cellulose with less dust and lower density compared to conventional cellulose of equivalent R-value. Lower dust content is preferred for indoor air quality. Low-density cellulose uses less material and helps in conserving resources.

1.3 R-value specified here should meet or exceed the R-value specified in Table 1-H or Table 1-I of 2001 Energy Commission Efficiency Standards For Residential And Nonresidential Buildings (adopted pursuant to Assembly Bill 970, Statutes of 2000).

1.4 Cellulose insulation is largely made up of recycled paper. High recycled content and bio-degradable components (except for chemicals added for fire retardancy and pest control) makes cellulose fiber insulation one of the most environmentally friendly insulation products. High recycled content removes a huge amount of material from the solid waste stream and also conserves landfill areas.

1.5 Cellulose consists mostly of bio-degradable components (except for chemicals added for fire retardancy and pest control). Minimal VOC content in the added chemicals, ensures good indoor air quality.

1.6 Meticulous preparation such as using vapor barriers, air barriers, tape, caulking, injecting foam sealant, overlapping foam sheathing etc., prior to installation reduces air exfiltration and moisture penetration, which adversely affects thermal performance and can promote undesirable conditions like bacterial growth, mildew, fungi, mold etc. Moisture deposition can also cause rotting of structural wood. Sealing potential leakage spots, and isolating cellulose insulation from HVAC ducts ensures that cellulose stays out of the living area air stream. Removing construction debris from the site ensures that the thermal performance of the insulation will not be affected after installation.

1.7 Proper installation procedure ensures that the expected thermal performance is achieved, and increases reusability potential of the material. Installing dry insulation is one of the ways of ensuring that moisture related problems won't occur. Proper installation ensures that the insulation is completely protected from high humidity, or exposure to extreme temperatures that can decompose chemicals added for fire retardancy, pest control etc. Proper installation is also critical in isolating cellulose dust (indoor air quality issue) from the living spaces.

1.8 The R-value of cellulose is dependant on the settled thickness of the material (as

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the material has a tendency to settle over a period of time), and uniformity of thickness over the surface. Adhering to the manufacturer's coverage specifications ensures that the recommended amount of insulation to provide the rated R-value is met.

1.9 Check local code for appropriate orientation or use of vapor barrier. The orientation of the vapor retarder is critical to avoid moisture deposition.

1.10 Commissioning agent should verify the following by doing spot checks at various locations in the ceilings and walls:

a. Commissioning agent shall examine wood studs and surfaces for signs of moisture such as mildew, peeling paint etc, and weak spots prior to installation. Installation shall not be completed until undesirable conditions have been rectified.

b. Commissioning agent shall do spot checks prior to installing insulation to check if all possible avenues for insulation to escape have been adequately sealed, and all heat producing devices have been appropriately isolated.

c. Commissioning agent shall do spot checks prior to installation of insulation in new construction to ensure that ventilation access has been provided as per specifications, small cavities around doors and windows have been insulated, blocking has been installed in prescribed areas, and areas in roofs that will become inaccessible after interior finish has been applied are insulated as per specifications.

d. Work shall be inspected prior to installation of insulation in existing construction to ensure that ventilation access has been provided as per specifications (by installing baffles).

e. Commissioning agent shall do a few spot checks to ensure that insulation covers entire surface, and uniformly at appropriate depth. Commissioning agent shall consider using an infrared scanner to ensure installed density meets specifications

f. Access panels and covers shall be inspected for appropriate insulation.

g. Material shall be completely dry before vapor retarders, foil and vinyl wall covering etc. are installed. Suitable electronic meters shall be used to ensure that the material is completely dry.

APPLICABILITY

2.1 Sealed cavities of walls of existing and new sidewalls and ceiling cavities.

2.2 Applicable only within specific temperature and humidity conditions.

2.3 Cannot be applied to access doors and panels.

COST IMPACT

3.1 For the same R-value, cellulose may save 20-40% more energy due to its capacity to stop air-infiltration.

3.2 Material cost: $0.08 per R-Value per square foot

3.3 Installed cost: $0.12 per R-Value per square foot

NOTES

3.4 However, costs vary from region to region.

EXAMPLE PRODUCTS AND MANUFACTURERS

4.1 "Therm-x," "R-Pro," "R-Pro Plus", "Energy Wise" and "CF" by Greenstone Industries/ Louisiana Pacific Corp. http://www.lpcorp.com

4.2 Wall-guard by CellPak. http://www.cellpak.com

REFERENCES FOR MORE INFORMATION

5.1 http://www.energyca.gov/efficiency/quality homes/insulation.html. (Installation and applicable standards).

5.2 http://www.cellulose.org/crs.htm. (Applicable standards and code regulations).

5.3 http://www.cellulose.org/consumer.htm. (Consumer Information).

5.4 http://www.cellulose.org/builder.htm. (Environmental and safety issues, applicable standards and code regulations).

5.5 http://www.cellulose.org/specs.htm. (Technical Specifications).

5.6 http://www.cellulose.org/fire-safe.htm. (Fire-safety issues).

5.7 California Energy Commission. 2001 Energy Commission Efficiency Standards For Residential And Nonresidential Buildings (adopted pursuant to Assembly Bill 970, Statutes of 2000).

5.8 Wilson, A. 1993. Environmental Building News. Vol. 2. Number 5. p.1 & pp. 12-17 (Environmental and indoor air quality issues during manufacture and installation of cellulose products).

5.9 Wilson, A. 1995. Environmental Building News. Vol. 4. Number 1. p.1 & pp. 11-17 (Environmental and indoor air quality issues during manufacture and installation of cellulose products).

5.10 CIMA, Cellulose Insulation: codes, regulations and specifications, CIMA Technical bulletin #1. Dayton, OH

5.11 CIMA, Consumer Update Insulation Effectiveness Bulletin, CIMA Technical bulletin #4. Dayton, OH (Cellulose versus glass fiber)

5.12 http://www.cellulose.org/practice.htm. (Installation procedure).

5.13 Demkin, J. A. 1997. Environmental Resource Guide. John Wiley and Sons. New York. (Environmental and indoor air quality issues during manufacture and installation of cellulose insulation products).

RELATED SPECIFICATION SECTIONS

6.1 07211 Glass Fiber Batt Building Insulation

6.2 07212 Mineral Wool Batt Building Insulation

6.3 07214 Glass Fiber Blown-in Building Insulation

6.4 07215 Mineral Wool Blown-in Building Insulation

6.5 07216 Cellulose Spray (Wall Cavity) Insulation

6.6 07217 Foam Board Building Insulation

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6.7 07218 Radiant Barrier Building Insulation

6.8 07220 Roof and Deck Insulation.

6.9 07240 Exterior Insulating Finish System (EIFS)

6.10 07300 Shingles, Roof Tiles and Roof Coverings

6.11 07500 Membrane Roofing

6.12 07610 Sheet Metal Roofing

6.13 07814 Cementitious Fireproofing

SECTION 07214 – GLASS FIBER (BLOWN-IN) BUILDING INSULATION

PART 1 - GENERAL

1.1 DEFINITIONS

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

1.2 SYSTEM DESCRIPTION

A. Glass fiber loose-fill insulation installed in [wall cavity] [ceiling cavity] to meet required thermal performance. *(Note 1.1)*.

1.3 SUBMITTALS

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

1.4 QUALITY ASSURANCE

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

1.5 DELIVERY, STORAGE AND HANDLING

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

1.6 WARRANTY

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

PART 2 - PRODUCTS

2.1 MATERIALS

A. Description: Loose-fill glass fiber insulation complying with the performance requirements of ASTM C 764, "Standard Specification for Mineral Fiber Loose-Fill Thermal Insulation". *(Note 1.1)*

B. Performance Requirements:

1. Walls (above grade): Insulation shall have a minimum rated R-value of ____ hr. sq. ft. °F/Btu. *(Note 1.2)*
2. Roof: Insulation shall have a minimum rated R-value of ____ hr. sq. ft. °F/Btu. *(Note 1.2)*
3. Recycled content: Minimum 18% post consumer, 7% post industrial (25% total) for glass fiber core. *(Note 1.3)*

C. Product shall emit no VOCs.

2.2 SOURCE QUALITY CONTROL

A. [See Section 07211 - Glass Fiber Batt Building Insulation].

PART 3 - EXECUTION

3.1 ACCEPTABLE INSTALLERS

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

3.2 PREPARATION

A. [See Section 07213 – Cellulose Spray (Loose) Building Insulation]

3.3 INSTALLATION

A. [See Section 07213 – Cellulose Spray (Loose) Building Insulation]

3.4 FIELD QUALITY CONTROL

A. [See Section 07213 – Cellulose Spray (Loose) Building Insulation]

3.5 CLEANING

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

END OF SECTION

NOTES

SECTION 07214 – GLASS FIBER (BLOWN-IN) BUILDING INSULATION – NOTES

See also notes for Section 07211 - Glass Fiber Batt Building Insulation and Section 07213 – Cellulose Spray (Loose) Building Insulation.

JUSTIFICATION

1.1 ASTM C-764 covers material attributes such as, density, thermal resistance, surface burning characteristics, adhesive/cohesive strength, smoldering combustion, fungi resistance, corrosion, moisture vapor absorption, odor, and flame resistance permanency.

1.2 R-value specified here should meet or exceed the R-value specified in Table 1-H or Table 1-I of 2001 Energy Commission Efficiency Standards For Residential And Nonresidential Buildings (adopted pursuant to Assembly Bill 970, Statutes of 2000).

1.3 Recycled content reduces waste from the solid waste stream and uses less energy during the production process.

APPLICABILITY

2.1 [See notes for Section 07213 – Cellulose Spray (Loose) Building Insulation]

COST IMPACT

3.1 Material cost: $0.11 for glass fiber (per R-Value per square foot).

3.2 Installed cost: $0.13 for glass fiber (per R-Value per square foot).

3.3 However, costs vary from region to region.

EXAMPLE PRODUCTS AND MANUFACTURERS

4.1 InsulSafe®4 by CertainTeed. http://www.certainteed.com/

REFERENCES FOR MORE INFORMATION

5.1 California Energy Commission. 2001 Energy Commission Efficiency Standards For Residential And Nonresidential Buildings (adopted pursuant to Assembly Bill 970, Statutes of 2000).

5.2 Demkin, J. A. 1997. Environmental Resource Guide. John Wiley and Sons. New York. (Environmental and indoor air quality issues during manufacture and installation of glass fiber insulation products).

5.3 Wilson, A. 1995. Environmental Building News. Vol. 4. Number 1. p.1 & pp. 11-17 (Environmental and indoor air quality issues during manufacture and installation of insulation products).

RELATED SPECIFICATION SECTIONS

6.1 07211 Glass Fiber wool Batt Building Insulation

6.2 07212 Mineral Wool Batt Building Insulation

6.3 07213 Cellulose Spray (Loose) Building Insulation

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6.4 07215 Mineral Wool Blown-in Building Insulation
6.5 07216 Cellulose Spray (Wall Cavity) Insulation
6.6 07217 Foam Board Building Insulation
6.7 07218 Radiant Barrier Building Insulation
6.8 07220 Roof and Deck Insulation.
6.9 07240 Exterior Insulating Finish System (EIFS)
6.10 07300 Shingles, Roof Tiles and Roof Coverings
6.11 07500 Membrane Roofing
6.12 07610 Sheet Metal Roofing
6.13 07814 Cementitious Fireproofing

SECTION 07215 – MINERAL WOOL (BLOWN-IN) BUILDING INSULATION

PART 1 - GENERAL

1.1 DEFINITIONS

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

1.2 SYSTEM DESCRIPTION

A. Mineral wool loose-fill insulation installed in [wall cavity] [ceiling cavity] to meet required thermal performance. *(Note 1.1)*.

1.3 SUBMITTALS

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

1.4 QUALITY ASSURANCE

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

1.5 DELIVERY, STORAGE AND HANDLING

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

1.6 WARRANTY

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

PART 2 - PRODUCTS

2.1 MATERIALS

A. Description: Loose-fill mineral wool insulation complying with the performance requirements of ASTM C 764, "Standard Specification for Mineral Fiber Loose-Fill Thermal Insulation". *(Note 1.1)*

B. Performance Requirements:

1. Walls (above grade): Insulation shall have a minimum rated R-value of ____ hr. sq. ft. °F/Btu. *(Note 1.2)*.
2. Roof: Insulation shall have a minimum rated R-value of ____ hr. sq. ft. °F/Btu. *(Note 1.2)*.

C. Recycled content: Minimum 75% post industrial for mineral wool core.

D. Product shall emit no formaldehyde when tested per § 01350.

2.2 SOURCE QUALITY CONTROL

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

PART 3 - EXECUTION

3.1 ACCEPTABLE INSTALLERS

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

3.2 PREPARATION

A. [See Section 07213 – Cellulose Spray (Loose) Building Insulation]

3.3 INSTALLATION

A. [See Section 07213 – Cellulose Spray (Loose) Building Insulation]

3.4 FIELD QUALITY CONTROL

A. [See Section 07213 – Cellulose Spray (Loose) Building Insulation]

3.5 CLEANING

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

END OF SECTION

NOTES

SECTION 07215 – MINERAL WOOL (BLOWN-IN) BUILDING INSULATION – NOTES

See also notes for Section 07211 - Glass Fiber Batt Building Insulation, Section 07212 – Mineral Wool Batt Building Insulation and Section 07213 – Cellulose Spray (Loose) Building Insulation.

JUSTIFICATION

1.1 ASTM C-764 covers material attributes such as, density, thermal resistance, surface burning characteristics, adhesive/cohesive strength, smoldering combustion, fungi resistance, corrosion, moisture vapor absorption, odor, and flame resistance permanency.

1.2 R-value specified here should meet or exceed the R-value specified in Table 1-H or Table 1-I of 2001 Energy Commission Efficiency Standards For Residential And Nonresidential Buildings (adopted pursuant to Assembly Bill 970, Statutes of 2000).

APPLICABILITY

2.1 [See notes for Section 07213 – Cellulose Spray (Loose) Building Insulation.]

COST IMPACT

3.1 Installation cost of less than $.50 per square foot of R-19 installed.

EXAMPLE PRODUCTS AND MANUFACTURERS

4.1 "Enviroguard Gold" and "E.G. 2000," by American Rockwool, Inc. http://www.amerrock.com/

4.2 “Premium™ Blowing Wool,” by FIBREX, Inc. http://www.fibrex.on.ca/

REFERENCES FOR MORE INFORMATION

5.1 California Energy Commission. 2001 Energy Commission Efficiency Standards For Residential And Nonresidential Buildings (adopted pursuant to Assembly Bill 970, Statutes of 2000).

5.2 Demkin, J. A. 1997. Environmental Resource Guide. John Wiley and Sons. New York. (Environmental and indoor air quality issues during manufacture and installation of glass fiber insulation products).

5.3 Wilson, A. 1995. Environmental Building News. Vol. 4. Number 1. p.1 & pp. 11-17 (Environmental and indoor air quality issues during manufacture and installation of insulation products).

RELATED SPECIFICATION SECTIONS

6.1 07211 Glass fiber wool Batt Building Insulation

6.2 07212 Mineral wool Batt Building Insulation

6.3 07213 Cellulose Spray (Loose) Building Insulation

6.4 07214 Glass Fiber Blown-in Building Insulation

6.5 07216 Cellulose Spray (Wall Cavity) Insulation

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6.6 07217 Foam Board Building Insulation

6.7 07218 Radiant Barrier Building Insulation

6.8 07220 Roof and Deck Insulation

6.9 07240 Exterior Insulating Finish System (EIFS)

6.10 07300 Shingles, Roof Tiles and Roof Coverings

6.11 07500 Membrane Roofing

6.12 07610 Sheet Metal Roofing

6.13 07814 Cementitious Fireproofing

SECTION 07216 – CELLULOSE SPRAY (WALL CAVITY) BUILDING INSULATION

PART 1 - GENERAL

1.1 DEFINITIONS

A. [See also Section 07211 - Glass Fiber Batt Building Insulation]

B. Overspray – Portion of the material from a spray pattern not filling or adhering to intended substrates.

C. Dry-weight – Weight of water divided by weight of dry cellulose*. (Note 1.1)*.

1.2 SYSTEM DESCRIPTION

A. Cellulose wet spray insulation installed in [wall cavity] to meet the required thermal performance*. (Note 1.1).*

1.3 SUBMITTALS

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

1.4 DELIVERY, STORAGE AND HANDLING

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

1.5 WARRANTY

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

PART 2 - PRODUCTS

2.1 MATERIALS

A. Description: Cellulose spray insulation complying with the performance requirements of ASTM C 1149, " Standard Specification for Self-Supported Spray Applied Cellulosic Thermal/Acoustical Insulation)". (*Note 1.2)*

B. Performance Requirements:

1. Walls (above grade): Insulation shall have a minimum rated R-value of ____ hr. sq. ft. °F/Btu. (*Note 1.3)*
2. Roof: Insulation shall have a minimum rated R-value of ____ hr. sq. ft. °F/Btu. (*Note 1.3)*

C. Recycled content: Minimum 50% total recycled content, 18% of which shall be post consumer recycled content. (*Note 1.4)*

D. Product shall emit no VOCs.

E. Cellulose manufactured using the fiberization process is recommended. *(Note 1.5)* [Optional].

F. Cellulose using less than 40% water on a dry-weight basis during the installation process is recommended. *(Note 1.5)*

2.2 SOURCE QUALITY CONTROL

A. Recyclability: Project goal is to recycle all overspray.

PART 3 - EXECUTION

3.1 ACCEPTABLE INSTALLERS

A. Installer shall recycle the overspray insulation.

3.2 PREPARATION *(NOTE 1.6)*

A. [See also Section 07213 – Cellulose Spray (Loose) Building Insulation]

B. Liquid flow tests shall be made periodically to ensure a proper liquid to fiber ratio. *(Note 1.7)*

3.3 INSTALLATION *(NOTE 1.8)*

A. Use manufacturer's specification for moisture content.

B. Each layer shall be sprayed evenly and there shall be no voids between each layer. Insulation shall be filled right up to the top. Do not overfill the cavity. The cavities under windows, soffits etc. shall be filled to the very top as well. *(Note 1.9)*

C. The cavity shall be filled to a uniform thickness. The stud shall be wiped off periodically to get an accurate idea of the actual thickness of cavity. *(Note 1.10)*

D. The excess material shall be trimmed with a wall scrubber and recycled.

E. The interior finish shall not be installed until the insulation layer has dried sufficiently (having a measured moisture content of 25% or less). *(Note 1.11)*

F. The excess material (overspray) shall be recycled. The overspray shall be consistently blended with the dry product and the proper liquid to fiber ratio ensured before spraying begins.

G. Vapor retarders:

1. For cold or mild climates: The vapor retarder shall be installed on the wall that is in contact with the interior space. *(Note 1.12).*
2. For hot and humid climates: The vapor retarder should be installed on the wall that is in contact with the exterior. *(Note 1.12).*

3.4 FIELD QUALITY CONTROL

A. Commissioning agent shall be notified reasonably ahead of time to allow for inspection and verify that the approved insulation material is used and installed as per specifications after the preparation stage, and before the insulation is covered with interior finish. *(Note 1.13)*

3.5 CLEANING

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

END OF SECTION

NOTES

SECTION 07216 – CELLULOSE SPRAY (WALL CAVITY) BUILDING INSULATION – NOTES

[See also notes for Section 07211 - Glass Fiber Batt Building Insulation, and Section 07213 – Cellulose Spray (Loose) Building Insulation]

JUSTIFICATION

1.1 Wet spray cellulose, as the name implies, has water added during installation to make it stick when blown into wall cavities (binders are sometimes used as well). Conventional wet-spray cellulose using a hammermill product is usually installed quite wet—sometimes with more than 100% water on a “dry-weight” basis (weight of water divided by weight of dry cellulose), or about four gallons of water per 30- pound bag.

1.2 ASTM C-1149 covers 10 material attributes: Density, thermal resistance, surface burning characteristics, adhesive/cohesive strength, smoldering combustion, fungi resistance, corrosion, moisture vapor absorption, odor, and flame resistance permanency. Material installed using liquid adhesive (Type I) also has substrate deflection and air erosion characteristic requirements. Under C-1149 spray-applied material is tested in the sprayed state.1.3 R-value specified here should meet or exceed the R-value specified in Table 1-H or Table 1-I of 2001 Energy Commission Efficiency Standards For Residential And Nonresidential Buildings (adopted pursuant to Assembly Bill 970, Statutes of 2000).

1.4 Recycling reduces material from the solid waste stream and reduces energy used during the production process. North America produces roughly 13 million tons of newspaper each year—about 100 pounds per person. Fifty-five percent of this is currently recycled (1992) according to the American Forest and Paper Association; the rest accounts for about 4.6% of municipal solid waste. While these statistics are a big improvement over ten years ago when newspaper accounted for 8% of our municipal solid waste, we still landfill or incinerate a huge amount. There are various ways old newspaper can be recycled. The biggest use, turning it back into new newspaper, requires significant processing (de-inking and bleaching, for example). Recycling newsprint to make cellulose insulation is a less energy intensive process.

1.5 A relatively new formulation of cellulose insulation, referred to as stabilized cellulose, is used in attics. This product has a binder in it and is applied with a small quantity of water. The binder prevents settling, which may otherwise reduce the installed thickness of loose-fill cellulose insulation by as much as 25%. A newer process, known as fiberization disaggregates newsprint back into individual fibers instead of cutting the paper. Fiberization produces lower density cellulose with a number of advantages. Cellulose manufactured using the fiberization process reduces the water content required during the installation process. Some products use less than 30% water during the installation process. Minimizing the amount of water used in the installation process conserves resources.

1.6 Elaborate preparation before application of wet spray cellulose helps in achieving maximum thermal benefit. Areas must be effectively sealed prior to the installation process, to reduce air infiltration. Preparing the work surfaces

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appropriately and keeping debris away from the insulation also enables recycling the overspray from the application.

1.7 A liquid flow test is extremely important to minimizing waste due to overspray. This is also crucial when the recycle method is used for spraying, as the recycled material already has a significant moisture content and is mixed with the dry insulation.

1.8 Proper installation procedure ensures that the expected thermal performance is achieved. Recommended water content, uniformity of application, and proper finishing ensures that rated thermal performance is achieved.

1.9 This ensures structural integrity of the insulation layer. Gaps would also adversely affect thermal value of the insulation.

1.10 This will help in judging the thickness of the overspray, and ensure that the insulation is sprayed to the recommended thickness.

1.11 Water content in the cellulose both before and after application affects R-value of the installed product. Moisture content is a significant concern in the wet-spray for several reasons – inadequate drying of the installed layer reduces R-value, promotes mold, mildew problems as well as structural problems.

1.12 Check local code for use and orientation of vapor barrier.

1.13 The commissioning agent shall ensure that the intent of the specifications has been met by verifying the following by doing spot checks at various locations in the walls.

a. Work shall not be accepted unless all specifications have been met.

b. Work shall be inspected at prior to the application stage to check if all leakages have been adequately sealed, and all heat producing devices have been appropriately isolated, and all drops, scuttles, braces and top plates have been covered.

c. Work shall be inspected prior to application of insulation in new construction to ensure that small cavities around doors and windows have been insulated, and areas in roofs that will become inaccessible after interior finish has been applied are insulated as per specifications.

d. Application surface and floor shall be inspected prior to application to ensure that surfaces are clean and floor has been cleared of all debris.

e. During application stage, commissioning agent shall make a few random checks to see that the proper liquid ratio is maintained.

f. Commissioning agent shall do spot checks to ensure that cavity is filled uniformly and not overfilled.

g. Commissioning agent shall verify that the insulation has dried sufficiently as per specifications before vapor retarders, foil and vinyl wall covering etc. are installed on both sides of the insulation. Suitable electronic meters shall be used to ensure that the material is completely dry.

APPLICABILITY

2.1 Wall installation other than masonry walls.

NOTES

2.2 May not be applied to below grade or ground level walls unless specified by manufacturer's recommendations.

COST IMPACT

3.3 Using the recycle method increases labor costs as it is a more time consuming process.

3.4 Application process is more elaborate and hence more expensive than batt insulation.

3.5 Installation cost of $ 0.30 per square foot of R-19 installed.

EXAMPLE PRODUCTS AND MANUFACTURERS

4.1 Wall-guard by Cellpak. http://www.cellpak.com

4.2 Cocoon by Greenstone http://www.greenstone.com/index.htm

4.3 ThermoCon by ThermoCon Inc. http://www.thermocon.com/Frame.htm

4.4 Low Toxic, high thermal performance, 80% recycled fibers wet spray application by Contra Costa Insulation.

4.5 Spray-on "Celbar" and "K-13" insulation made from 75% post consumer and post industrial recycled newsprint and cardboard by International Cellulose Corp.

REFERENCES FOR MORE INFORMATION

5.1 http://www.cellulose.org/pdf/cellulose_bulletins/tech_bulletin1.pdf

5.2 California Energy Commission. 2001 Energy Commission Efficiency Standards For Residential And Nonresidential Buildings (adopted pursuant to Assembly Bill 970, Statutes of 2000).

5.2 http://www.energyca.gov/efficiency/quality homes/insulation.html. (Installation and applicable standards).

5.2 http://www.cellulose.org.

5.3 Wilson, A. 1993. Environmental Building News. Vol. 2. Number 5. p.1 & pp. 12-17 (Environmental and indoor air quality issues during manufacture and installation of cellulose products).

5.4 CIMA, Cellulose Insulation: codes, regulations and specifications, CIMA Technical bulletin #1. Dayton, OH.

5.5 http://www.naima.org/ (Environmental and health-related benefits of fiber glass, scheduling, installation and applicable standards).

5.6 CIMA, 1998. Standard Practice for Installation of Sprayed Cellulose Wall Cavity Insulation, CIMA Technical bulletin #3. Dayton, OH.

RELATED SPECIFICATION SECTIONS

6.1 07211 Glass Fiber Batt Building Insulation

6.2 07212 Mineral Wool Batt Building Insulation

6.3 07213 Cellulose Spray (Loose) Building Insulation

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6.5 07214 Glass Fiber Blown-in Building Insulation
6.6 07215 Mineral Wool Blown-in Building Insulation
6.7 07217 Foam Board Building Insulation
6.9 07218 Radiant Barrier Building Insulation
6.8 07220 Roof and Deck Insulation
6.9 07240 Exterior Insulating Finish System (EIFS)
6.10 07300 Shingles, Roof Tiles and Roof Coverings
6.11 07500 Membrane Roofing
6.12 07610 Sheet Metal Roofing
6.13 07814 Cementitious Fireproofing

END OF SECTION

SECTION 07217 – FOAM BOARD BUILDING INSULATION

PART 1 - GENERAL

1.1 DEFINITIONS

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

1.2 SYSTEM DESCRIPTION

A. Foam board insulation installed in [walls] [roof] [floor][foundation] to meet specified thermal performance.

1.3 SUBMITTALS

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

1.4 QUALITY ASSURANCE

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

1.5 DELIVERY, STORAGE AND HANDLING

A. [See also Section 07211 - Glass Fiber Batt Building Insulation]

B. Materials shall be protected from exposure to direct sunlight using an opaque, light-colored tarp or original manufacturer's packing. Unwrapped material shall be rewrapped using an opaque, light-colored tarp or packaging. *(Note 1.3)*

1.6 SCHEDULE

A. Roofing shall be finished. Roof must be designed and constructed to drain water within 48 hours after rainfall. *(Note 1.4)*

B. Waterproofing or damp proofing shall be completely cured before applying foam board to the foundation perimeter.

C. Construction debris shall be removed from spaces to be insulated.

1.7 WARRANTY

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

PART 2 - PRODUCTS

2.1 MATERIALS

A. Description: [Expanded Polystyrene] [Extruded polystyrene] [Polyisocyanurate] [Polyurethane]

B. Performance Requirements:

1. Walls (above grade): Insulation shall have a minimum rated R-value of ____ hr. sq. ft. °F/Btu. *(Note 1.5)*
2. Roof: Insulation shall have a minimum rated R-value of ____ hr. sq. ft. °F/Btu. *(Note 1.5)*

C. Provide products with the following recycled content. *(Note 1.6)*

1. Expanded Polystyrene: Provide product with minimum 50 percent recycled content.
2. Extruded polystyrene: Provide product with minimum 50 percent recycled content.
3. Polyisocyanurate: Provide product with minimum 9 percent recycled content.
4. Polyurethane: Provide product with minimum 5 recycled content percent.

D. Foil Facing: Provide product with minimum 80% recycled aluminum.

E. Expanding agent: Shall not contain CFCs. *(Note 1.7)*

2.2 SOURCE QUALITY CONTROL

A. Recyclability: Project goal is to provide products that are 100 percent recyclable.

PART 3 - EXECUTION

3.1 ACCEPTABLE INSTALLERS

A. [See also Section 07211 - Glass Fiber Batt Building Insulation]

3.2 PREPARATION *(NOTE 1.8)*

A. Substrate shall be flat, dry and free of honeycombs, fins or foreign material that will impede adhesive bond or damage the insulation board.

B. If siding is damaged the siding shall be removed and replaced, when installing insulation under siding.

C. If insulation is installed on steel decks after a complete tear-off or in new construction, edges shall be checked so that no edges are left unsupported along the flanges.

3.3 INSTALLATION *(NOTE 1.8)*

A. Examine product, with installer present, for manufacturer's packaging. Product shall be free of ripped back and edges.

B. Insulation shall be completely dry prior to installation.

C. Wood studs shall be examined for moisture content. They shall not exceed 19% moisture content at the time of installation.

D. Substrate shall be completely dry before installing the insulation board.

E. Substrate shall not be installed during predominantly inclement weather conditions.

F. Examine siding for damage when installing insulation in siding.

G. Foam boards shall not be used as an exposed interior finish in occupied buildings. A suitable barrier shall be installed to isolate the insulation from the interior space. Extruded Polystyrene shall not be installed where it may be in contact with surfaces whose constant temperature is in excess of 165 °F.

H. Vapor barrier shall be used as per building codes. *(Note 1.9)*

1. For cold or mild climates: Vapor retarder shall be installed in the warm in winter side of the insulation.
2. For hot and humid climates: Vapor retarder shall be facing the exterior.

I. Insulation board shall be tightly fitted/butted against each other or framing members, or sealed to provide an airtight assembly.

J. Insulation shall be cut to fit around all penetrations and projections with a maximum allowable gap of 1/4 in. Open joints shall be repaired with like insulation material.

K. Interior Foundation Wall:
   1. Metal or minimum 1¼ in. treated wood furring strips shall be attached at the base of the masonry strip using common masonry fasteners.
   2. In cold climates, extend over the floor / soil by 1 ft to 2 ft. Insulation shall be held in place by compressing the insulation between a wood tack strip and the sill plate.
   3. Band joist area shall be filled with insulation board.

L. Exterior Foundation Walls:
   1. Foam board shall be installed from the top of the footing upwards, directly over the exterior of the concrete, block or wood foundations and shall be applied to the wall using common masonry fasteners, or a recommended adhesive or both. If fasteners are used, the penetration area around the fastener shall be sealed to prevent moisture and air infiltration.
   2. If the insulation board has grooved drainage channels on one face, they shall be installed against the foundation wall and connected to a foundation tile and gravel drainage system to provide protection for waterproofing and drainage of the subsurface soil moisture.
   3. The backfill soil shall be placed directly in contact with the board. The board shall be in full contact with the foundation.
   4. Board shall not be left exposed above the gradeline. Board shall be covered with [masonry veneer] [cementitious coatings] [siding].
   5. Surrounding grade/concrete slabs shall be sloped away from foundation.

M. Wood Stud walls:
   1. The foam board shall be installed vertically with seams located on studs using fasteners. If construction tape is used over joints, insulation surface shall be clean and dry before installing the tape.

N. Steel Stud Walls / Masonry Veneer:
   1. 2 in. minimum clear space (or as per manufacturer's specifications) shall be provided between the inside brick face and the exterior surface of the insulation board.
   2. Insulation board joints shall be tightly fitted with tape.
   3. Adequate flashings, functioning weep-holes and caulk movement joints shall be provided.

O. Furred Masonry Wall (Interior):
   1. All joints shall be sealed with a suitable sealant or tape.

P. Cavity Masonry wall:
   1. Joints and openings shall be sealed with tape as per manufacturer's specifications.
   2. Subsequent courses shall be installed with staggered joints.
   3. 1 in. minimum clear space shall be provided between inside brick face and the

exterior surface of the insulation.

4. Adequate flashings, functioning weep holes and caulk movement joints shall be provided.

Q. Exterior Sheathing Frame System:
   1. Foam board shall be installed vertically with edges tightly butted, staggered joints and interlocked board edges. Foam board joints shall not be placed over joints in the substrate. Corners shall be interlocked and board joints shall be offset a minimum of 8 in. from the corners of the fenestration openings. Nails or staples shall not be overdriven, as this will damage the insulation.
   2. The seams shall be sealed with tape or caulking, to provide an airtight assembly.
   3. Siding material [wood] [vinyl] [hardboard] [brick veneer] [stucco] [EIFS] [aluminum] shall be installed as per manufacturer's instructions, as soon as possible.
   4. Refer to Section 07240 – External Insulation Finish Systems.

R. Sloping roof systems:
   1. Wood deck panels shall be installed with a minimum 1/8 in. gap to allow for expansion.
   2. Refer Section 07500 – Membrane Roofing.

S. Mechanically fastened roof systems:
   1. For mechanically fastened roof systems: The insulation shall be loosely laid or mechanically fastened to the existing roof deck.
   2. [Specify for multilayer installations]: Subsequent layer of insulation shall be laid unattached over the first layer. All joints shall be staggered in relation to the underlying layer. The bottom layer shall have a minimum thickness of 2 in. and shall be at least as thick as the top layer.
   3. For fully and partially adhered roofing systems or a mechanically fastened single ply membrane, a barrier board (minimum ¾ in. perlite , ½ in. wood fiber, ½ in. gypsum board etc.) shall be placed between the foam board and the roofing membrane.
   4. The fasteners used to attach foamed plastic and cover board to steel deck, shall have insulation plates.
   5. Installer shall ensure that the installed insulation is not exposed to sun or wind, by covering all insulation with adequate weight and an opaque membrane. *(Note 1.3)*
   6. Only as much insulation that can be covered shall be laid in one day.

   Refer to Section 07500 – Membrane Roofing.

T. Ballasted Protected Roof Membrane Assembly (PRMA):
   1. Insulation shall be tightly butted together (unless specified otherwise by manufacturer), with rain channels facing down, over a non-degradable, bond-breaking slip-sheet as recommended by the membrane manufacturer.
   2. [Specify for multilayer installations]: Subsequent layer of insulation shall be laid unattached over the first layer. All joints shall be staggered in relation to the underlying layer. The bottom layer shall have a minimum thickness of 2 in. and shall be at least as thick as the top layer.
   3. A protective mat shall be placed loosely between the ballast and the insulation

(except when using pavers as ballast) perpendicular to the long dimension of the insulation board. All joints shall be lapped a minimum of 12 in.. There shall not be any end laps within 6ft of the perimeter. The fabric shall extend 2 in. – 3 in. above the stone at the perimeter and all penetrations. Wetting the fabric is helpful in holding it in place till ballast is installed.

4. [See Section 07500 – Membrane Roofing]
5. When pavers are used as ballast, supports or pedestals shall be used to support the pavers, to maintain a minimum of ½ in. air space.
6. Ballast, smooth 2 in. x 2 ft. x 2 ft. concrete pavers, water worn gravel or crushed stone shall be applied immediately to hold the system in place.

3.4 FIELD QUALITY CONTROL *(NOTE 1.11)*

A. Commissioning agent shall be notified reasonably ahead of time to allow for inspection and verify that the approved insulation material is used and installed as per specifications after the preparation stage, and before the insulation is covered. *(Note 1.11)*

3.5 CLEANING

A. [See Section 07211 - Glass Fiber Batt Building Insulation].

END OF SECTION

NOTES

SECTION 07217 – FOAM BOARD BUILDING INSULATION – NOTES

[See also notes for Section 07211 - Glass Fiber Batt Building Insulation]

JUSTIFICATION

1.1 Insulation reduces energy consumption in a building.

1.2 Blown foam products have the highest R-Value per inch compared to most other insulating materials. Polyisocyanurate insulation board has the highest insulation value per inch (9.0 hr. sq. ft. °F/Btu). They are useful in places where a high insulation value is required but there isn't enough space available for using other insulation products with lower R-value per inch. Foam board does not have any undesirable indoor air quality impact. It is a concern only for those with chemical sensitivity.

1.3 Foam board is susceptible to UV light and should be protected from it to ensure continued thermal performance.

1.4 Incorporating effective drainage when installed in roof ensures maximum thermal performance.

1.5 R-value specified here should meet or exceed the R-value specified in Table 1-H or Table 1-I of 2001 Energy Commission Efficiency Standards For Residential And Nonresidential Buildings (adopted pursuant to Assembly Bill 970, Statutes of 2000).

1.6 Products with 100% recycled content are available and recommended. Certain foam board products also recycle by-products from the chemical stream of the anti-freeze industry and by-products from the production of dimethyl-terephthalate. Recycled plastic (a material hard to recycle) is also used in the manufacture of certain foam board products. Foam board made by recycling these materials is recommended. Expanded polystyrene products can be recycled in some areas for manufacturing into new styrene products.

1.7 CFCs that were traditionally used as a blowing agent in foam boards deplete the ozone layer and must be avoided.

1.8 Careful preparation such as clean and dry substrate and product ensures that the rested thermal performance of the insulation is not affected.

1.9 Careful storage and installation are important for maximum thermal performance. Gaps, rips or tears reduce the overall R-value of the product. The presence of moisture on site or in the vicinity of the insulation also reduces effective R-value. The product is most effective when properly installed with minimal thermal breaks, air gaps, and adequately ventilated when required.

1.10 Check local code for vapor barrier use and orientation.

1.11 Commissioning agent shall so spot checks to ensure that the specifications are met:

a. Verify that insulation and surfaces that the insulation is in contact with are dry, and free of damage.

b. Verify that installation is installed to meet specifications when installed between framed cavity (sealed against air and moisture penetration, cut

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around penetrations, is not exposed to the sun, joints are staggered etc.).

c. Vapor barrier faces specified orientation.

d. Verify that drainage channels face specified orientation.

APPLICABILITY

2.1 Foundation slab

2.2 Interior and exterior application for foundation walls

2.3 Wood and metal stud walls

2.4 Masonry walls

2.5 Roof applications

COST IMPACT

EXAMPLE PRODUCTS AND MANUFACTURERS

4.1 "Tuff-R 'C' " (XPS) with R-value of 8.0 per inch thickness and Thermax by Celotex Corporation. http://www.owenscorning.com

4.2 "Ener-Grid" (XPS) with 86% recycled post-consumer industrial plastic by Ener-Grid. http://www.ener-grid.com

4.3 "EPS Board" with up to 100% post industrial and post consumer recycled content by N.P.S. Corp. (NPS).

4.4 "Chemfoam" (EPS) with up to 30% post consumer and 70% post industrial recycled plastic by Pacemaker Plastics Co., Inc. http://www.pacemakerplastics.com/

4.5 "Perform Roof Insulation" (EPS) with 25% post consumer recycled plastic by Pacific Allied Products.

4.6 "RCX" (XPS) with 25% post industrial and 25% post consumer recycled plastic by Tenneco Building Products, Inc. http://www.tennecobuildingprod.com/

4.7 INSULPINK by Owens Corning. http://www.owenscorning.com

4.8 Styrofoam by Dow. http://www.dow.com

4.9 Amofoam by Tenneco (Amoco Chemical Products). http://www.tennecobuildingprod.com/

REFERENCES FOR MORE INFORMATION

5.1 California Energy Commission. 2001 Energy Commission Efficiency Standards For Residential And Nonresidential Buildings (adopted pursuant to Assembly Bill 970, Statutes of 2000).

RELATED SPECIFICATION SECTIONS

6.1 07211 Glass Fiber Batt Building Insulation

6.2 07212 Mineral Wool Batt Building Insulation

6.3 07213 Cellulose Spray (Loose) Building Insulation

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6.4 07214 Glass Fiber Blown-in Building Insulation
6.5 07215 Mineral Wool Blown-in Building Insulation
6.6 07216 Cellulose Spray (Wall Cavity) Building Insulation
6.7 07218 Radiant Barrier Building Insulation
6.8 07220 Roof and Deck Insulation.
6.9 07240 Exterior Insulating Finish System (EIFS)
6.10 07300 Shingles, Roof Tiles and Roof Coverings
6.11 07500 Membrane Roofing
6.12 07610 Sheet Metal Roofing
6.13 07814 Cementitious Fireproofing

SECTION 07218 – RADIANT BARRIER BUILDING INSULATION

PART 1 - GENERAL

1.1 DEFINITIONS

A. Emittance: The ratio of the radiant heat flux emitted by a specimen to that emitted by a black body at the same temperature and the same conditions.

B. Reflectance: Percentage of radiant energy reflected by a material.

1.2 SYSTEM DESCRIPTION

A. Radiant barrier installed to maximize thermal performance.

1.3 SUBMITTALS

A. SPECIAL ENVIRONMENTAL REQUIREMENTS: Submit the following in accordance with the requirements of Section 01350:

1. Resource efficient product data: Submit required information concerning project recyclability (packaging), product recycled content, and product recyclability.
2. Environmental issues certification: Submit written certification stating that the products installed are essentially the same as those defined by the Project requirements (specifications, submittals, and/or test data) in terms of recycled content, recyclability and indoor air quality.

1.4 QUALITY ASSURANCE

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

1.5 DELIVERY, STORAGE AND HANDLING

A. Refer to Section 01350 – Special Environmental Requirements.

B. Shall be stored flat on a level surface in a dry, well-ventilated building.

C. Shall be stored at temperatures and humidity conditions recommended by the manufacturer.

D. Shall be protected from dust accumulation.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Description: Radiant barrier consisting of [one] [two] sheet/s of reflective coating applied to [one] [both] sides of substrate.

1. Radiant barrier: [Aluminum foil laminate] [Aluminized Plastic Film] [Low-emittance coating] *(Note 1.1)*
2. Substrate: [Kraft paper] [Plastic film] [Cardboard] [Plywood sheathing] [Air infiltration barrier material]

B. Performance requirements:

1. Emittance: Product emittance shall be tested as per ASTM E-408 and shall not exceedan emittance of 0.10.

C. Recycled content for plastic based substrate: Minimum 50% total, a minimum of which shall be 20% post-consumer recycled content for plastic based substrate. *(Note 1.2)*

D. Product shall be free of lead or mercury additives.

E. Product shall emit no VOCs.

PART 3 - EXECUTION

3.1 PREPARATION *(NOTE 1.3.*

A. Substrate shall be totally cleaned (by washing and using an appropriate cleaner) and degreased prior to application of radiant barrier.

B. Liquid application:

1. Aluminum and galvanized steel: Corrosion shall be removed with hand tool cleaning, steel wool or other abrasive method.
2. Drywall: All cracks and nail holes shall be filled with patching paste and smooth sand. Joint components shall be cured and sanded smooth. All sanding dust shall be removed. Water stains shall be sealed with a commercial stain killer.
3. Masonry, concrete, cement brick and block: All surfaces shall be completely cured. Rough surfaces shall be filled to provide a smooth finish. New construction shall be cured for at least 28 days.
4. Plaster: Plaster shall be cured and hard. Surface shall be completely dry before application.
5. Steel: Rust and mill scale shall be removed using sand paper, steel wool, or other abrading methods. Bare steel shall be primed the same day as cleaned.
6. Wood: Exposed wood shall be sanded to a fresh wood surface. All nail holes and imperfections shall be patched with a wood filler or putty and sanded to a smooth finish.
7. Previously painted surface: All loose coatings and corrosion shall be removed. Glossy and non-porous surface shall be dulled with sandpaper. Surface shall be patched, filled and primed as requirement to have a smooth finish.

C. Surface shall be cleaned of mildew.

3.2 INSTALLATION

A. An air space shall be adjacent to the radiant barrier.

1. Double-sided radiant barrier shall have an air space on both sides.
2. One-sided radiant barrier shall have an air space adjacent to the reflective side. *(Note 1.4)*

B. When used as a vapor barrier all joints and seams shall be butted against each other and taped or overlapped and taped. *(Note 1.5)*

C. While installing a radiant barrier, existing insulation shall not be compressed. *(Note 1.6)*

D. Roof application:

1. Structural sheathing application: The reflective side of the radiant barrier shall face downward into the dropped ceiling or attic space.

2. Reinforced sheet radiant barrier material [with/without perforations]:
    a. Top of roof rafters: Radiant barrier shall be draped on top of rafters draping downward to at least 3/4 in. between the rafters to create an air space on both sides of the radiant material. Shiny side shall face down [for one-sided radiant barrier]. *(Note 1.7)*
    b. Underside of rafters: Radiant barrier shall be stapled to the underside of the rafter and draped below to maintain a minimum 3/4 in. air space on both sides of the radiant barrier. This application shall be combined with a continuous ridge-and-soffit vent system. Shiny side shall face down [for one-sided radiant barrier]. Alternately, radiant barrier shall be stretched shiny side facing down and stapled on to the sides of the rafters to maintain a minimum airspace of 3/4 in. on either side.
    c. Above roof deck: Radiant barrier shall be laid on top of roof deck with the shiny side facing up and a minimum of 3/4 in. air gap between the radiant barrier and roofing material above.

E. Wall application:
    1. Wood stud wall:
        a. Foil faced glass fiber batts shall be stapled to the sides of the wall space leaving an air space between the foil facing and the interior sheathing.
        b. Foil faced dry wall shall be installed over furring strips on the interior stud faces. *(Note 1.8)*

F. Floor application: Radiant barrier shall be stapled to the underside of floor joists (above unheated basements or crawl spaces) to create a single reflective air space, or between the joists, followed by insulating sheathing to create two separate reflective surfaces.

3.3 FIELD QUALITY CONTROL

A. Commissioning agent shall be notified reasonably ahead of time to allow for inspection and verify that the approved radiant barrier is used and installed as per specifications. (*Note 1.9)*

3.4 CLEANING

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

END OF SECTION

NOTES

SECTION 07218 – RADIANT BARRIER BUILDING INSULATION – NOTES

JUSTIFICATION

1.1 Radiant barriers lower energy consumption in a building by reducing radiant heat transfer across open spaces. Conventional insulation is only partially effective against radiant heat. The potential benefit of radiant barriers is primarily in reducing air-conditioning cooling loads in warm or hot climates. By virtue of its impermeable surface, reflective insulation also reduces convective heat transfer. The reduction of temperatures is less important in highly insulated ceiling spaces (R-30 or higher), with respect to conduction through the ceiling. If air-conditioning ductwork is located in the dropped ceiling, lowering the temperature reduces the heat gain on ductwork. Examples of radiant barrier include:

a. Aluminum foil laminate: Aluminum foil laminated with Kraft paper, plastic film, or OSB/plywood roof sheathing.

b. Aluminized plastic film: Thin layer of aluminum deposited on film using a vacuum process.

c. Low-emittance coating: Liquids that reduce the emittance of the surface to which they are applied.

1.2 Radiant barriers do not use significant recycled content due to lower reflectivity of recycled aluminum. Tom Miller of Environmentally Safe Products says that aluminum with recycled content does not have the reflectivity needed for good radiant barrier performance. Choose a product that has the maximum recycled content for the specified reflectance.

1.3 Careful preparation ensures that radiant barrier can be firmly bonded with the substrate without any irregularities in the surface, which would lower the thermal performance.

1.4 Unless the shiny side has an air space next to it, the radiant barrier will not be effective.

1.5 Sealing all the joints and seams when using the radiant barrier as a vapor barrier, reduces the possibility of moisture condensation. Wherever possible, provide a mechanical seal, such as folded and stapled flaps. Most tapes will eventually fail.

1.6 Avoid compressing insulation when installing a radiant barrier because that reduces the insulation's effective R-value.

1.7 The reflective side should be protected from dust accumulation (by facing it downwards when installed in a ceiling/roof application) to ensure maximum thermal performance. Orienting the shiny side to face upwards may sometimes be unavoidable, in which case the space it is installed in shall be sealed against dust infiltration as far as possible.

1.8 Furring strips create an air space between the wall cavity and the wall insulation.

1.9 Commissioning agent shall do spot checks to ensure that the shiny side of the radiant barrier faces the specified orientation (has an air-space next to the shiny side) and is protected from dust.

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APPLICABILITY

2.1 Radiant barrier sheet applied under roof decks and above an attic or dropped ceiling.

2.2 Radiant barrier insulation applied within wall constructions and over roof deck.

2.3 Especially appropriate when ducts are located in the space under the roof deck.

2.4 Most appropriate in warm climates.

COST IMPACT

3.1 Stapled to bottom of roof rafter: $0.20 – $0.45/sq. ft.

3.2 Draped over rafters: $0.12 – $0.35/sq. ft.

3.3 Laminated to roof deck: $0.12 – $0.30/sq. ft.

EXAMPLE PRODUCTS AND MANUFACTURERS

4.1 Radiant barrier with 40% recycled content by Low-e Insulation. http://www.low-e.com

4.2 "Tempshield" radiant barrier with 20% recycled plastic bubble wrap by Sealed Air Corp. http://www.sealedair.com/

4.3 Astro-foil by Reflectech. http://www.videcomp.com/reflectech

4.4 “TechShield”, www.lpcorp.com

REFERENCES FOR MORE INFORMATION

5.1 http://www.rima.net/

5.2 Holmes, D.1999. Green Spec. E-Build Inc.(Product directory and guideline specifications for environmentally friendly building products).

5.3 1995. Environmental Building News. Volume 4, Number 2.

RELATED SPECIFICATION SECTIONS

6.1 07211 Glass Fiber Batt Building Insulation

6.2 07212 Mineral Wool Batt Building Insulation

6.3 07213 Cellulose Spray (Loose) Building Insulation

6.4 07214 Glass Fiber Blown-in Building Insulation

6.5 07215 Mineral Wool Blown-in Building Insulation

6.6 07216 Cellulose Spray (Wall Cavity) Building Insulation

6.7 07217 Foam Board Building Insulation

6.8 07220 Roof and Deck Insulation.

6.9 07240 Exterior Insulating Finish System (EIFS)

6.10 07300 Shingles, Roof Tiles and Roof Coverings

6.11 07500 Membrane Roofing

6.12 07610 Sheet Metal Roofing

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6.13 07814 Cementitious Fireproofing

SECTION 07240 – EXTERIOR INSULATING FINISH SYSTEM (EIFS)

PART 1 - GENERAL

1.1 DEFINITIONS

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

1.2 SYSTEM DESCRIPTION

A. EIFS installed in [walls] to meet specified thermal performance.

1.3 SUBMITTALS

A. SPECIAL ENVIRONMENTAL REQUIREMENTS: Submit the following in accordance with the requirements of Section 01350:
   1. Resource efficient product data: Submit required information concerning project recyclability (packaging), product recycled content, and product recyclability.
   2. Environmental issues certification: Submit written certification stating that the products installed are essentially the same as those defined by the Project requirements (specifications, submittals, and/or test data) in terms of recycled content, recyclability and indoor air quality.

1.4 QUALITY ASSURANCE

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

1.5 DELIVERY, STORAGE AND HANDLING

A. [See Section 07217 – Foam Board Building Insulation]

1.6 WARRANTY

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

PART 2 - PRODUCTS

2.1 MATERIALS

A. Description: EIFS.

B. Performance requirements: Walls (above grade): Insulation shall have a minimum rated R-value of ____ hr. sq. ft. °F/Btu. *(Note 1.2)*

C. Substrate: [Cement Board] [High performance gypsum-fiber panels] [Standard glass-mat panels] [Paper-faced gypsum panels] [Wood-based sheathing].

D. Insulation: [Molded expanded polystyrene (EPS)] [Extruded polystyrene (XPS)] [Polyisocyanurate] [Polyurethane]
   1. Refer to Section 07217 – Foam Board Building Insulation.

E. Finish: Shall have a minimum reflectance of ___. *(Note 1.3)*

PART 3 - EXECUTION

3.1 PREPARATION *(NOTE 1.4)*

A. Substrate shall be completely dry and cured before installing the insulation board.

B. Substrate shall be free of planar irregularities greater than 1/4 in. in every 10 in. *(Note 1.5)*

C. Substrate shall be free of conditions such as moisture, dust, grease, oil, paint or foreign material that will impede adhesive bond or damage the insulation board. *(Note 1.5)*

1. Gypsum sheathing: Shall be free of warping, cracks and fins.
2. New concrete substrate: Shall have a minimum curing period of 28 days before any application.

D. Substrate shall not be installed during predominantly inclement weather conditions.

E. Gypsum sheathing with any sign of rot, dampness, dirt or damage shall be rejected and replaced.

3.2 INSTALLATION

A. Water management materials and assemblies shall be installed at terminations, interruptions (such as at control joints, expansion joints, doors and windows) or transition in the exterior substrate that are potential points for water infiltration. *(Note 1.6)*

B. Irregularities in the insulation shall be leveled and base coat shall be applied uniformly over the insulation. *(Note 1.5)*

C. Foam board application: Refer to Section 07217 – Foam Board Building Insulation.

D. Further application over the foam board surface shall not resume till the curing period as per manufacturer's specifications has been met.

E. Base coat shall be applied uniformly over the insulation board and the reinforcing mesh shall be embedded on it, with the edges overlapped by a minimum of 2 in. inches. Edges of heavy duty reinforcing meshes shall be butted and not overlapped. All corners and exposed edges shall be wrapped. No further work shall resume on this surface till it has been cured as per manufacturer's specifications.

F. Backer rods/ bond breakers and sealants shall be applied to joints between panels, expansion joints or where system abuts other materials.

3.3 FIELD QUALITY CONTROL

A. Commissioning agent shall be notified reasonably ahead of time to allow for inspection and verify that the approved insulation material is used and installed. (*Note 1.7)*

3.4 CLEANING

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

END OF SECTION

NOTES

SECTION 07240 – EXTERIOR INSULATING FINISH SYSTEM (EIFS) – NOTES

[See also notes for Section 07211 - Glass Fiber Batt Building Insulation and Section 07217 – Foam Board Building Insulation].

JUSTIFICATION

1.1 Exterior insulation finish systems provide thermal efficiency and weather resistance.

1.2 R-value specified here should meet or exceed the R-value specified in Table 1-H or Table 1-I of 2001 Energy Commission Efficiency Standards For Residential And Nonresidential Buildings (adopted pursuant to Assembly Bill 970, Statutes of 2000).

1.3 Consider specifying a high reflectance surface to keep the wall cooler in the sun. A reflectance of 0.70 or greater is recommended for cooling energy savings.

1.4 Proper preparation and installation ensures that EIFS is not susceptible to moisture, which reduces thermal performance.

1.5 Ensuring uniformity of EIFS surface and substrate ensures a firm bond between the two surfaces. Gaps between the substrate and insulation lower thermal performance.

1.6 Careful attention to water management is critical to avoid moisture accumulation, which can lead to mold growth and/or structural damage.

1.7 Commissioning agent shall verify that insulation and substrate is dry, clean and free of damage, and that all joints are sealed with appropriate sealant to prevent air and moisture infiltration.

APPLICABILITY

2.1 Concrete or concrete masonry walls.

2.2 Metal-framed walls, where the insulation sheathing provided as part of the EIFS will reduce thermal bridging.

COST IMPACT

3.1 Typically more expensive (per insulation R-value) than glass fiber or cellulose cavity insulation, so an EIFS is typically used for applications like those listed above where cavity insulation is not applicable or is insufficient.

EXAMPLE PRODUCTS AND MANUFACTURERS

4.1 “Sparfil®” Wall System by Sparfil Blok Florida, Inc.

4.2 “R-Control” Foam-core containing 15% recycled plastic by Big Sky Insulation, Inc.

REFERENCES FOR MORE INFORMATION

RELATED SPECIFICATION SECTIONS

6.1 07211 Glass fiber wool Batt Building Insulation

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6.2 07212 Mineral wool Batt Building Insulation
6.3 07213 Cellulose Spray (Loose) Building Insulation
6.4 07214 Glass Fiber Blown-in Building Insulation
6.5 07215 Mineral Wool Blown-in Building Insulation
6.6 07216 Cellulose Spray (Wall Cavity) Building Insulation
6.7 07217 Foam Board Building Insulation
6.8 07218 Radiant Barrier Building Insulation
6.9 07220 Roof and Deck Insulation
6.10 07300 Shingles, Roof Tiles and Roof Coverings
6.11 07500 Membrane Roofing
6.12 07610 Sheet Metal Roofing
6.13 07814 Cementitious Fireproofing

SECTION 07300 – SHINGLES, ROOF TILES, AND ROOF COVERINGS

PART 1 - GENERAL

1.1 DEFINITIONS

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

B. U-Factor: The thermal conductance of an assembly at temperature of 75 °F in units of Btu/hr. sq. ft. °F.

C. Emittance: The ratio of the radiant heat flux emitted by a specimen to that emitted by a black body at the same temperature and the same conditions.

D. Reflectance: Percentage of radiant energy reflected by a material.

1.2 SYSTEM DESCRIPTION

A. [Asphalt shingles][Clay tiles][Cedar shingles][Slate]

1.3 SUBMITTALS

A. SPECIAL ENVIRONMENTAL REQUIREMENTS: Submit the following in accordance with the requirements of Section 01350:

1. Resource efficient product data: Submit required information concerning project recyclability (packaging), product recycled content, and product recyclability.
2. Environmental issues certification: Submit written certification stating that the products installed are essentially the same as those defined by the Project requirements (specifications, submittals, and/or test data) in terms of recycled content, recyclability and indoor air quality.

1.4 QUALITY ASSURANCE

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

1.5 DELIVERY, STORAGE AND HANDLING

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

PART 2 - PRODUCTS

2.1 MATERIALS

A. Performance Requirements:

1. Roof assembly shall have a U-factor of ___ Btu/hr. sq. ft. °F. (*Note 1.4)*
2. Product shall be ENERGY STAR compliant.
3. Reflectance: Product shall have a minimum initial reflectance of at least __ and three-year-aged reflectance of at least __ when tested in accordance with ASTM E903. (*Note 1.5)*
4. Emmittance: Product shall have an emittance at least 0.75 when tested in accordance with ASTM 408.

B. Asphalt shingles: *(Note 1.6)*

1. [Organic felt] [Glass fiber mat]
2. Recycled content for asphalt shingles: Minimum 25% recycled content. *(Note*

1.3)

3. Shall be UV resistant. *(Note 1.7)*

C. Clay tiles:
   1. Shall be sourced locally. *(Note 1.8)*

D. Cedar shingles:
   1. Use FSC-certified sustainably harvested wood from well-managed forests. *(Note 1.9)*

E. Slate:
   1. Shall be sourced from local quarry.

PART 3 - EXECUTION

3.1 PREPARATION

A. Prior to and during application, the contractor shall ensure that all dirt, debris, sharp edges, grease and dust shall be removed from surfaces to be roofed for both new and re-roofing substrates.

B. Substrate shall not have voids greater than 1/4 in. wide.

C. Substrate shall be dry before membrane is installed.

D. Blisters, buckles and ridges shall be cut and patched to provide a level substrate surface.

E. Contractor shall ensure that roof drain lines are unblocked before starting work.

F. Requirement and direction of vapor retarder shall be determined as per local building code.

3.2 INSTALLATION *(NOTE 1.10)*

A. Shall be installed only under environmental conditions specified by the manufacturer.

B. Only as much roofing (including flashing) as can be made weather-tight on the same day shall be installed.

C. When removing an existing roof during re-roofing, only as much roofing (including flashing) shall be removed as can be replaced and made weather-tight using roofing materials on the same day.

D. Any paint or coating applied on the membrane shall be compatible with the manufacturer's specifications.

3.3 FIELD QUALITY CONTROL

A. Commissioning agent shall be notified reasonably ahead of time to allow for inspection and verify that the approved roof material is used and installed. (*Note 1.11)*

3.4 CLEANING

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

END OF SECTION

NOTES

SECTION 07300 – SHINGLES, ROOF TILES, AND ROOF COVERINGS – NOTES

JUSTIFICATION

1.1 In selecting material for roofing one should take into account its weight (heavier materials require larger support material – more intensive use of resources), its durability and thermal properties (U-factor, emittance and reflectance). Other critical factors determining the choice of the membrane are natural resources (high recycled content, recylability), quantity and toxicity of pollution generated during the manufacturing process. Products made from ecologically sensitive resources shall be avoided. Regionally manufactured products use less transportation energy. Higher recycled content ensures fewer manufacturing and landfill impacts. Low U-factor, high reflectivity and high emittance reduce cooling loads.

1.2 Roofs commonly exhibit lowest durability of any major building component except carpeting. The manufacturing process also produces a relatively high degree of pollution. Most of the roofing membranes are not bio-degradable and an environmental hazard even when they are discarded. Any measure that will increase a roof's longevity would save resources, save energy and decrease pollution.

1.3 Aside from investing in better roofing material, regional and climatic consideration can affect roof durability. Different roofing membranes have different weathering characteristics – some products stand up well to intense heat and UV radiation, but deteriorate rapidly in repeated freeze-thaw cycles. Local conditions such as hurricanes, hail etc. also effect longevity. The complete roofing assembly will be critical in determining the longevity of the membrane. Flashing details shall be designed with the longevity of the roofing material in mind, accommodating any maintenance requirements.

1.4 U-factor for the roof construction shall meet or exceed the thermal performance specified in Table 1-H or Table 1-I of 2001 Energy Commission Efficiency Standards For Residential And Nonresidential Buildings (Adopted Pursuant To Assembly Bill 970, Statutes Of 2000).

1.5 A highly reflective roof surface remains much cooler than a typical medium or dark colored roof and offers many benefits: reduced cooling energy cost, smaller air conditioning equipment, and longer roof life. The EnergyStar program lists sloped roofing products with reflectance of 0.25 or greater. However, some sloped roof products are available with much higher reflectance.

1.6 Asphalt shingles typically have an energy intensive production process. High recycled content reduces the energy used during production and also removes solid waste from landfills. Asphalt shingles can use recycled mixed paper in their base, and some use reclaimed material in the surface aggregate. Organic felt uses recycled content, where as glass fiber mats do not use any recycled content, but can last up to 60 years when installed properly. Asphalt roofing materials can be recycled into road paving or patch materials. Unless recycling options are available, asphalt shingles are best avoided.

1.7 UV resistant products have a higher durability.

1.8 Locally sourced material has lowers embodied energy as energy used for

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transportation is minimized.

1.9 Theoretically wood comes from a renewable source of energy. Sourcing wood from a well managed forest ensures that the wood that is being consumed is being restored by replantation.

1.10 Careful installation ensures that there are no potential leakages, and ensures efficient drainage that reduces moisture related damage and problems.

1.11 Commissioning agent shall ensure that the intent of the specification is met by verifying the following:

a. Check that the substrate is clean and dry before roofing material is installed.

b. Check that the roofing materials are undamaged and dry.

c. Check that the specified drainage and vent requirements are met.

APPLICABILITY

2.1 A high albedo surface may be applied to almost any roof. Cool roofs are most important in warm climates and are especially effective on roofs with little or no insulation.

2.2 See also 07610 Sheet Metal Roofing for high albedo specifications for some sloped roof applications. (e.g. to system types, construction types, occupancy types).

COST IMPACT

EXAMPLE PRODUCTS AND MANUFACTURERS

4.1 “QuiLine” roofing fabric by Bonded Fiber Products, Inc.

4.2 Organic roofing felt by Tamko Roofing Products, Inc.

4.3 Recycling by Reclaim Inc. of Tampa, Florida.

REFERENCES FOR MORE INFORMATION

5.1 EnergyStar. www.energystar.gov.

RELATED SPECIFICATION SECTIONS

6.1 07211 Glass fiber wool Batt Building Insulation

6.2 07212 Mineral wool Batt Building Insulation

6.3 07213 Cellulose Spray (Loose) Building Insulation

6.4 07214 Glass Fiber Blown-in Building Insulation

6.5 07215 Mineral Wool Blown-in Building Insulation

6.6 07216 Cellulose Spray (Wall Cavity) Building Insulation

6.7 07217 Foam Board Building Insulation

6.8 07218 Radiant Barrier Building Insulation.

6.9 07220 Roof and Deck Insulation

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6.10 07240 Exterior Insulating Finish System (EIFS)

6.11 07500 Membrane Roofing

6.12 07610 Sheet Metal Roofing

6.13 07814 Cementitious Fireproofing

SECTION 07500 – MEMBRANE ROOFING

PART 1 - GENERAL

1.1 DEFINITIONS

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

B. Emittance: The ratio of the radiant heat flux emitted by a specimen to that emitted by a black body at the same temperature and the same conditions.

C. Reflectance: Percentage of radiant energy reflected by a material.

1.2 SYSTEM DESCRIPTION

A. Single ply roof membrane: [TPO] [EPDM]

1.3 SUBMITTALS

A. SPECIAL ENVIRONMENTAL REQUIREMENTS: Submit the following in accordance with the requirements of Section 01350:

1. Resource efficient product data: Submit required information concerning project recyclability (packaging), product recycled content, and product recyclability.
2. Environmental issues certification: Submit written certification stating that the products installed are essentially the same as those defined by the Project requirements (specifications, submittals, and/or test data) in terms of recycled content, recyclability and indoor air quality.

1.4 QUALITY ASSURANCE

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

1.5 DELIVERY, STORAGE AND HANDLING

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

B. Membrane rolls shall be stored flat and a few inches off the ground.

PART 2 - PRODUCTS

2.1 MATERIALS

A. Description: Single ply roofing system:

1. Thermoplastic Membrane: TPO (thermoplastic polyolefin)
2. Thermoset Membrane: EPDM (ethylene propylene diene monomer)

B. Performance Requirements:

1. Roof assembly shall have a U-factor of ___ Btu/hr. sq. ft. °F. (*Note 1.4)*
2. Product shall be ENERGY STAR compliant.
3. Reflectance: Product shall have a minimum initial reflectance of at least 0.65 and three-year-aged reflectance of at least 0.5 when tested in accordance with ASTM E903. (*Note 1.5)*
4. Emittance: Product shall have an emittance at least 0.75 when tested in accordance with ASTM 408.

C. Fire Retardant shall not contain chlorine or halogenated fire retardants.

PART 3 - EXECUTION

3.1 PREPARATION *(NOTE 1.6)*

A. Prior to and during application, the contractor shall ensure that all dirt, debris, sharp edges, grease and dust shall be removed from surfaces to be roofed for both new and re-roofing substrates.

B. Substrate shall not have voids greater than 1/4 in. wide.

C. Substrate shall be dry before membrane is installed.

D. Blisters, buckles and ridges shall be cut and patched to provide a level substrate surface.

E. Contractor shall ensure that roof drain lines are unblocked before starting work.

F. Requirement and direction of vapor retarder shall be determined as per local building code.

G. Insulation shall be installed as a separation layer over the existing surface and/or to obtain specified thermal value.

1. [See Section – 07217 – Foam Board Building Insulation]

3.2 INSTALLATION *(NOTE 1.7)*

A. Shall be installed only under environmental conditions specified by the manufacturer.

B. Only as much roofing (including flashing) as can be made weather-tight on the same day shall be installed.

C. When removing an existing roof during re-roofing, only as much roofing (including flashing) shall be removed as can be replaced and made weather-tight using roofing materials on the same day.

D. Membrane Installation:

1. Insulation shall be compatible with membrane as specified by manufacturer.
2. Metal flashing: Metal flashing shall be installed around the roof perimeter and roof penetrations. *(Note 1.3)*
3. Joints shall be watertight and staggered over nailer joints to prevent joints in nailers and joints in flashing from aligning. Metal edges shall not cut the membrane.
4. Adhered TPO/EPDM Roofing Membrane:
    a. Membrane shall be rolled out and laid flat. Membrane shall run perpendicular to the direction of deck flutes and the orientation of wood decks. Membrane installed around the perimeter shall be installed parallel to the perimeter edge.
    b. Sheets shall be overlapped by at least 3 in.. Sheets shall be overlapped in the direction of water-flow (like shingles) (*Note 1.7)*
    c. Creased or damaged membrane shall be replaced. Manufacturer's recommended adhesive shall be used. There shall be no air gaps, between the substrate and the membrane.
5. Mechanically Fastened TPO/EPDM Roofing Membrane:

a. Wood nailers shall be installed at the perimeter of the roof and around all penetrations and projections, and firmly anchored to the deck. Vent space shall be provided between adjacent lengths of nailers.
b. Membrane shall be installed immediately after installation of slip sheet.
c. Membrane shall be rolled out and laid flat. Membrane shall run perpendicular to the direction of deck flutes and the orientation of wood decks.
d. Sheets shall be overlapped by at least 5 in. Sheets shall be overlapped in the direction of water-flow (like shingles). *(Note 1.7)*
e. Seams shall be welded continuously.

6. Ballasted membrane system:
   a. Membrane shall be loosely laid over the insulation.
   b. Ballast shall be loosely laid over the membrane.
7. Any paint or coating applied on the membrane shall be compatible with the manufacturer's specifications.
8. Ballast: As per manufacturer's specifications.

3.3 FIELD QUALITY CONTROL

A. Commissioning agent shall be notified reasonably ahead of time to allow for inspection and verify that the approved membrane is used and installed. (*Note 1.8)*

3.4 CLEANING

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

END OF SECTION

NOTES

SECTION 07500 – MEMBRANE ROOFING – NOTES

JUSTIFICATION

1.1 In selecting material for roofing one should take into account its weight (heavier materials require larger support material – more intensive use of resources), its durability and thermal properties (U-factor, emittance and reflectance).Other critical factors determining the choice of the membrane are natural resources (high recycled content, recylability), quantity and toxicity of pollution generated during the manufacturing process. Products made from ecologically sensitive resources shall be avoided. Regionally manufactured products use less transportation energy. Higher recycled content ensures fewer manufacturing impact and landfill impacts. Materials with high recycled content also have lower energy consumption during Low U-factor, high reflectivity and high emittance reduces cooling loads.

1.2 Roofs commonly exhibit lowest durability of any major building component except carpeting. The manufacturing process also produces a relatively high degree of pollution. Most of the roofing membranes are not bio-degradable and an environmental hazard even when they are discarded. Any measure that will increase a roof's longevity would save resources, save energy and decrease pollution.

1.3 Aside from investing in better roofing material, regional and climatic consideration can affect roof durability. Different roofing membranes have different weathering characteristics – some products stand up well to intense heat and UV radiation, but deteriorate rapidly in repeated freeze-thaw cycles. Local conditions such as hurricanes, hail etc. also effect longevity. The complete roofing assembly will be critical in determining the longevity of the membrane. Flashing details shall be designed with the longevity of the roofing material in mind, accommodating any maintenance requirements.

1.4 U-factor specified here shall meet or exceed the thermal performance specified in Table 1-H or Table 1-I of 2001 Energy Commission Efficiency Standards For Residential And Nonresidential Buildings (Adopted Pursuant To Assembly Bill 970, Statutes Of 2000).

1.5 A highly reflective roof surface remains much cooler than a typical medium or dark colored roof and offers many benefits: reduced cooling energy cost, smaller air conditioning equipment, and longer roof life.

1.6 Careful preparation ensures that the substrate is clean, dry and level before installing roof membrane. A clean, dry and level substrate is important in ensuring that the membrane adheres properly to the substrate and reduces frequency of replacement.

1.7 Careful installation ensures that there are no potential leakages, and ensures efficient drainage that reduces moisture related damage and problems.

1.8 Commissioning agent shall ensure that the intent of the specification is met by verifying the following:

a. Check that the substrate is clean, level and dry before membrane is installed.

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b. Check that membrane is undamaged and dry.

c. Check that there are no air gaps between the membrane and the substrate.

d. Verify that the membrane faces the specified orientation, the joints are staggered and overlapped as per specifications.

e. Check that the specified drainage and vent requirements are met.

APPLICABILITY

2.1 A high albedo surface may be applied to almost any roof, although it is especially easy on flat or low-slope roofs because they allow the use of white single-ply membranes or liquid-applied coatings. These coatings are most important in warm climates and are especially effective on roofs with little or no insulation.

2.2 See also 07610 Sheet Metal Roofing for high albedo specifications for some sloped roof applications. (e.g. to system types, construction types, occupancy types).

COST IMPACT

3.1 In many cases, a white, reflective membrane is available at no extra cost compared to a similar black membrane. If there is an extra cost, then it may be balanced by longer roof life and reduced replacement cost.

3.2 A white liquid-applied coating costs $0.30 to $2.00 per sq. ft to install.

3.3 Elastomeric Coatings and Single Ply membranes cost $ 1.50 to $ 3.50 per sq. ft. to install.

EXAMPLE PRODUCTS AND MANUFACTURERS

4.1 “QuiLine” roofing fabric by Bonded Fiber Products, Inc.

4.2 Organic roofing felt by Tamko Roofing Products, Inc.

4.3 Recycling by Reclaim Inc. of Tampa, Florida.

REFERENCES FOR MORE INFORMATION

5.1 1995. Environmental Building News. Volume 4, Number 4. Roofing materials.

RELATED SPECIFICATION SECTIONS

6.1 07211 Glass fiber wool Batt Building Insulation

6.2 07212 Mineral wool Batt Building Insulation

6.3 07213 Cellulose Spray (Loose) Building Insulation

6.4 07214 Glass Fiber Blown-in Building Insulation

6.5 07215 Mineral Wool Blown-in Building Insulation

6.6 07216 Cellulose Wet Spray Building Insulation

6.7 07217 Foam Board Building Insulation

6.8 07218 Radiant Barrier Building Insulation.

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6.9 07220 Roof and Deck Insulation

6.10 07240 Exterior Insulating Finish System (EIFS)

6.11 07300 Shingles, Roof Tiles, and Roof Coverings

6.12 07610 Sheet Metal Roofing

6.13 07814 Cementitious Fireproofing

SECTION 07610 – SHEET METAL ROOFING

PART 1 - GENERAL

1.1 DEFINITIONS

A. [See Section 07211 - Glass Fiber Batt Building Insulation and Section 07300 – Shingles, Roof Tiles, and Roof Coverings]

1.2 SYSTEM DESCRIPTION

A. Sheet metal roofing installed to meet the required thermal performance. (*Note 1.3)*

1.3 SUBMITTALS

A. [See Section 07211 - Glass Fiber Batt Building Insulation].

1.4 QUALITY ASSURANCE

A. [See Section 07211 - Glass Fiber Batt Building Insulation].

1.5 DELIVERY, STORAGE AND HANDLING

A. [See Section 07211 - Glass Fiber Batt Building Insulation].

1.6 WARRANTY

A. [See Section 07211 - Glass Fiber Batt Building Insulation].

PART 2 - PRODUCTS

2.1 MATERIALS

A. Description: [Aluminum] [Steel]

B. Performance Requirements:
   1. Roof Assembly shall have a U-factor of ____ Btu/hr.sq. ft. °F.(*Note 1.3)*
   2. Coating: [Zinc] [Pure Aluminum] [Galvalume (45% zinc and 55% aluminum)] [Polyester Resin]. (*Note 1.4)*
      a. Coating shall have a reflectance of over 0.65.

C. Provide products with the following recycled content – (*Note 1.6)*
   1. Provide steel roofing with at least 14% post consumer recycled content (25% total recycled content).
   2. Provide aluminum roofing with at least 75% recycled content.
   3. Provide steel tile roofing with at least 66% recycled content.
   4. Provide aluminum shake with at least 95% recycled content.
   5. Provide copper shingles with at least 85% recycled content.
   6. Fasteners:
      a. Fastening system shall be compatible with thermal expansion and contraction of the steel sheet.

2.2 SOURCE QUALITY CONTROL

A. [See Section 07211 - Glass Fiber Batt Building Insulation].

PART 3 - EXECUTION

3.1 INSTALLATION

A. Over solid deck: Z-shaped metal sleepers shall be installed over the deck. (*Note 1.7)*

3.2 CLEANING

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

END OF SECTION

NOTES

SECTION 07610 – SHEET METAL ROOFING – NOTES

JUSTIFICATION

1.1 In selecting material for roofing one should take into account its weight (heavier materials require larger support material – more intensive use of resources), its durability and thermal properties (U-factor, emittance and reflectance).

1.2 Other critical factors determining the choice of the membrane are natural resources (high recycled content, recylability), quantity and toxicity of pollution generated during the manufacturing process. Products made from ecologically sensitive resources shall be avoided. Regionally manufactured products use less transportation energy. Higher recycled content ensures fewer manufacturing impact and landfill impact. Low U-factor, high reflectivity and low emittance reduce cooling loads.

1.3 U-factor specified here shall meet or exceed the thermal performance specified in Table 1-H or Table 1-I of 2001 Energy Commission Efficiency Standards For Residential And Nonresidential Buildings (Adopted Pursuant To Assembly Bill 970, Statutes Of 2000).

1.4 Metal roofs have a high durability. White metal roofs have a high reflectance and in conjunction with insulation have a low-U factor. Aluminum or galvalume (zinc-aluminum alloy) coatings have a lifetime of at least 20 years and can last 40 years, as opposed to zinc coating which has a life time of only 5 years. Zinc coating can be reclaimed completely. Steel roofs are extremely durable. Silicone modified polyester finishes have a lifetime of 20 years.

1.5 Steel roofing material is made exclusively at large plants that process raw iron and is very energy intensive to manufacture. The manufacturing process also produces a relatively high degree of pollution. Metal roofing not bio-degradable.

1.6 Metal roof materials with high recycled content reduce impact on non-renewable resources and lower energy consumption during the manufacturing process. Steel and aluminum can be easily recycled in their post-use phase. Recycled aluminum uses only 15% of the energy of the virgin material.

1.7 Dark colored roof panels absorb maximum heat and experience large thermal movement (expansion and contraction due to temperature changes), increasing the fastener hole size, resulting in leaks. Panels installed over purlins will not harm the roof.

APPLICABILITY

COST IMPACT

EXAMPLE PRODUCTS AND MANUFACTURERS

4.1 Rustic Shingle from Classic products, Inc.

REFERENCES FOR MORE INFORMATION

RELATED SPECIFICATION SECTIONS

6.1 07211 Glass fiber wool Batt Building Insulation

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6.2 07212 Mineral wool Batt Building Insulation
6.3 07213 Cellulose Spray (Loose) Building Insulation
6.4 07214 Glass Fiber Blown-in Building Insulation
6.5 07215 Mineral Wool Blown-in Building Insulation
6.6 07216 Cellulose Wet Spray Building Insulation
6.7 07217 Foam Board Building Insulation
6.8 07218 Radiant Barrier Building Insulation
6.9 07220 Roof and Deck Insulation
6.10 07240 Exterior Insulating Finish System (EIFS)
6.11 07300 Shingles, Roof Tiles and Roof Coverings
6.12 07500 Membrane Roofing
6.13 07610 Sheet Metal Roofing

SECTION 07814 – CEMENTITIOUS FIREPROOFING

PART 1 - GENERAL

1.1 SUBMITTALS

A. SPECIAL ENVIRONMENTAL REQUIREMENTS:

Submit the following in accordance with the requirements of Section 01350:

1. Resource efficient product data: Submit required information concerning project recyclability (packaging), product recycled content, and product recyclability.
2. Environmental issues certification: Submit written certification stating that the products installed are essentially the same as those defined by the Project requirements (specifications, submittals, and/or test data) in terms of recycled content and recyclability.
3. Indoor air quality: Submit Material Safety Data Sheets (MSDS) and emission test data for both fireproofing and sealer. For assembly systems (e.g., floor and wall systems where the finish material is installed over a substrate, either with or without the use of adhesives), individual components of the system shall be tested separately. If all components meet the criteria established in Section 01350, no further testing shall be required. If one or more of the components of a system does not meet the criteria, the material may be tested again as an assembly. If this option to re-test is selected, then the specimen preparation must be constructed following manufacturer's recommended procedures for application of wet components and assembly of the system. If there is a difference between the manufacturer's recommended procedures and procedures required by the project specifications, request clarification from the Architect.

1.2 QUALITY ASSURANCE

1. Certification

1.3 DELIVERY STORAGE AND HANDLING

A. Comply with the packaging, delivery, storage and handling requirements of section 01350.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 CLEANING

A. [See Section 07211 - Glass Fiber Batt Building Insulation]

B. Remove overspray from adjacent surfaces.

END OF SECTION