

U. S. DEPARTMENT OF HOUSING AND URBAN DEVELOPMENT
HOUSING - FEDERAL HOUSING COMMISSIONER

REGIONAL ADMINISTRATORS, DIRECTORS,
TO: OFFICES OF REGIONAL HOUSING, FIELD
OFFICE MANAGERS AND SUPERVISORS

SERIES AND SERIES NO.

USE OF MATERIALS

BULLETIN NO. 74

DATE

October 13, 1977

SUBJECT: THERMAL INSULATION, UREA-BASED, FOAMED IN PLACE

Members of the HUD Staff processing cases and inspecting construction shall use this information in determining acceptability of the subject material. for the uses indicated

This bulletin should be filed with Bulletins on Special Methods of Construction and Materials as required by prescribed procedures. Additional copies may be requisitioned by the field offices.

The We technical description, requirements and limitations expressed herein do not constitute ail endorsement, approval or acceptance by the Department of Housing and Urban Development (*HUDIFHA*) of the subject matter, and any statement or representation, however made, indicating approval or endorsement by the Department of Housing and Urban Development is *unauthorized and false*, and will be considered a violation of the United States Criminal Code 18, U. S. C 709.

Any reproduction of this Bulletin must be in its entirety and any use in sales promotion or *advertising is not authorized.*

Subject to good workmanship, compliance with applicable codes, and the methods of application listed herein, the materials described in this bulletin may be considered suitable for HUD Housing Programs, including Housing for the Elderly and Care-Type Housing.

The eligibility of a property under these Programs is determined on the property as an entity and involves the consideration of underwriting and other factors not indicated herein. Thus, compliance with this bulletin should not be construed as qualifying the property as a whole, or any part thereof, as to its eligibility.

The methods of application-for the materials listed herein are to be considered as part of the HUD Minimum Property Standards and shall remain effective until this bulletin is cancelled or superseded.

SCOPE

1.1 This is a Provisional bulletin and applies to urea-based thermal insulation for use in walls in building constructions. This bulletin sets forth conditions of acceptance, which include material properties, test methods, installation guidelines, and material, application and labeling requirements for the use of foamed-in-place urea-based resin insulation. The material is accepted for use only in enclosed building cavities such as walls, partitions and floors.

1.2 For more information on uses, see par. 7.3

1.3 This Provisional bulletin is prepared in S.I. units of measurement, often referred to as the metric system. The approximate equivalents in customary units are given in parenthesis. For assistance in converting between the two systems of measurement, the reader is referred to ASTM E 380.

2. APPLICABLE PUBLICATIONS

2.1 The following Publications are applicable to this Provisional bulletin.

2.1.1 American Society for Testing and Materials (ASTM)

- C 177 Steady-State Thermal Transmission Properties by Means of the Guarded Hot Plate
- C 236 Thermal Conductance and Transmittance of Built-Up Sections by Means of the Guarded Hot Box
- C 518 Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter
- D 257 D-C Resistance or Conductance of Insulating Materials
- D 1622 Apparent Density of Rigid Cellular Plastics
- E 84 Surface Burning Characteristics of Building Materials

E 119 Fire Tests of Building Construction and
Materials

E 380 Metric Practice Guide

2.1.2 National Fire Protection Association (NFPA)

90B Warm Air Heating and Air Condition Systems

3. GENERAL REQUIREMENTS (ADDITIONAL REQUIREMENTS ARE GIVEN IN PARA.7)

3.1. Acceptable material shall be urea-based thermosetting foam, suitable for filling closed cavities through small holes and suitable also for filling open cavities by trowelling during foaming prior to enclosure.

3.2 Manufacturers of the material shall provide to their distributors or applicators its effective thermal resistance values (par. 7.3.3).

3.3 Where urea-based foam is used to insulate the exterior walls of new construction, the interior face of the wall shall be covered with gypsum wallboard complying with and mechanically fastened in accordance with the requirements of the HUD Minimum Property Standards (MPS). The gypsum wallboard shall have a minimum thickness of 12.7mm (1/2 in). Other suitable materials having a finish rating of 15 minutes (minimum) per ASTM E-119 may be used in lieu of gypsum wallboard.

Exterior walls of new construction, multi-story housing shall, be firestopped at each floor level and at the ceiling of the uppermost story.

The urea-based insulation shall be installed with no portion exposed at the completion of construction or in existing construction. This requirement includes attention to architectural detailing at the base and ceiling, around doors and windows, and around openings penetrating the wall cavity for utilities or other purposes.

3.4 Adequate clearance between the insulation and heat-sources shall be provided. Consult NFPA 90B, Warm Air Heating & Air Conditioning Systems. Protection of insulation at penetrations (heat sources) is critical.

4

3.5 Because the chemical content of water can vary geographically the manufacturer shall provide a quality control system to test mixing water to assure Product consistency.

4 DETAIL REQUIREMENTS

4.2 RESIN PROPERTIES

4.1.1 FREE ALDEHYDE CONTENT - When tested as specified in par. 6.2.1, the free aldehyde content shall not exceed 1.0%.

CURING PROPERTIES

- 4.2.1 SETTING TIME - When tested as specified in par. 6.2.2, the foam shall set in not less than 20 s and not more than 60 s for application in closed cavities, and not less than 10 s and not more than 60 s for application in open cavities. At the setting time, the surface of the foam at the fracture shall be smooth and homogeneous.
- 4.2.2 VOLUME RESISTIVITY OF FRESH FOAM When - tested as specified in par. 6.2.3, the volume resistance shall not be less than $5 \text{ k} \hat{\text{ - cm}}$ (5,000 ohms - centimeter).
- 4.2.3 WATER DRAINAGE - When tested as specified in par. 6.2.4, no water shall leak from the cavity.
- 4.2.4 SHRINKAGE DURING CURING - When tested as specified in par. 6.2.5, the linear shrinkage in any direction shall not be more than 4.0%.
- 4.2.5 FUNGI GROWTH INHIBITION - When tested as specified in par. 6.2-6, the area of fungi growth in the test frame containing the foam specimen shall not be greater than 10% of that in the control test frame, and there shall be no fungi growth on the foam itself.

4.3 DRY FOAM PROPERTIES

4.3.1 DENSITY - When tested as specified in par. 6.1.4, the density of the dry foam shall be within the range of 10.4-15 kg/m³ (0.65-0.94 lb/ft³).

4-3.2 THERMAL RESISTANCE - When tested as specified-in par. 6.2.7, the thermal resistance shall not be less than 2.2 m² -C/W (12 ft²i F/Btu).

4.3.3 CORROSIVENESS - The material shall be tested as specified in par. 6.2.8. For aluminum, copper and steel there shall not be any perforations when the metal specimens are observed over a chrome reflected 40 W appliance light bulb. For galvanized steel there shall be no pitting of the metal specimen and its loss in mass shall not exceed 0.2 g (0.01 oz).

4.3.4 WATER ABSORPTION

4.3.4.1 FLOATING TEST - When tested as specified in par. 6.2.9.1, the water absorption shall not exceed 15% by volume.

4.3.4.2 DROPLET TEST - When tested as specified in par. 6.2.9.2, the drops of methyl violet solution applied to a horizontal surface of the foam shall not be absorbed within 1 h.

4.3.5 SURFACE BURNING CHARACTERISTICS - When tested as specified in par. 6.2.10, the flame spread classification shall not exceed 25.

4.3.6 ASH CONTENT - When tested as specified in par. 6.2.11, the volume of ash shall not be more than 2% of the original volume of the foam.

LABELING

5.1. Containers of urea-based resin and foaming agent shall bear labels:

5.1.1 Identifying the manufacturer of the product.

5.1.2 **Showing storage temperatures** and corresponding dates (shelf-life) after which resin and foaming agent are not usable.

5.1.3

Including the following statement: This material shall be applied by licensed applicators only and in strict accordance with HUD/FHA Minimum Property Standards, HUD/FHA Use of Materials Bulletin No. 74, and the manufacturer's instructions.

5.1.4 Including a warning to minimize the risk to life and health involved in the application of the Product, such as but not limited to: WARNING! Avoid Contact With Eyes, Nose and Skin! If contact is made rinse thoroughly with quantities of water.

5.2 If a flame spread classification for the foam insulation is included on the label, the following classification statement shall also be included: Values of flame spread rating are not intended to reflect hazards presented by this or any other material under actual fire conditions.

TESTING

6.1 SPECIMN PREPARATION

6.1.1 SAMPLING - Sampling shall be done at random.

6.1.2 PREPARATION OF SPECIMENS - Unless otherwise specified in the test procedure, the foam shall be prepared and applied in accordance with the manufacturer's instructions. The temperature of the unreacted materials prior to foaming shall be within the range 15-300C (59-86 F).

Unless otherwise specified in the test Procedure, specimens shall be foamed in closed cavities at ambient conditions of 23+2°C (73+4 F) and 50+5% M.

6.1.3 CONDITIONING - Specimens for tests 6.2.7 to 6.2.10 inclusive shall be maintained in the closed cavities in the vertical position at 23+20C (73+4 F) and 50+5% RH for 28 days prior to testing.-

6.1.4 DENSITY - The density of the dry foam shall be within the range 10.4-15 kg/m³ (0.65-0.94 lb/f t³), when determined according to ASTM D 1622. Foam used for tests 6.2.2 to 6.2.6 inclusive shall be such that upon drying for 28 days at 23+20C (73+4 F) and 50+5% RH a density within the above range would be realized.

6.2 TEST PROCEDURE

6.2.1 FREE ALDEHYDE CONTENT - Prepare a standard sulphite solution as follows. Dissolve, without heating, approximately 250g Na₂SO₃·7H₂O in about 200 ml distilled water. Dilute to one litre. Adjust the pH of the sulphite solution to 8.9 with H₂SO₄ and NaOH solutions. The solution is stable only for a short period of time and it should be used immediately after adjustment of the pH. Place 20 ml distilled water in an Erlenmeyer flask. Accurately weigh approximately 2g resin solution (ready for foaming) and add it to the flask. Stir the mixture well, add approximately 10g crushed ice and mix thoroughly. Add 50.0 ml of the standard sulphite solution and titrate immediately with NaOH to pH 8.9. Perform the procedure in duplicate and run a blank.

Calculate the percentage formaldehyde content of the resin as follows:

$$\text{percent aldehyde} = \frac{3(A-B)D}{C}$$

where: A = ml of 0.01N H₂SO₄ for the specimen

B = ml of 0.01N H₂SO₄ for the blank

C = mass of resin solution

D = normality of the H₂SO₄ solution

6.2.2 SETTING TIME - A conical specimen with a bottom diameter of approximately 30 cm (12 in) and a height of approximately 30 cm (12 in) shall be made by foaming from a hose. **Start a stopwatch** immediately after the cone has been formed and immediately commence slicing the cone with a spatula. Record the time when the foam no longer slices as if it were whipped cream but shears off leaving a smooth surface. This time is the setting time. Evaluate the surfaces of the slices visually for smoothness and homogeneity.

- 6.2.3 VOLUME RESISTIVITY OF FRESH FOAM - Determine the volume resistivity of the foam 15 min after foaming as specified in ASTM D 257 using metal plate electrodes, 90 x 90 mm (3.5 x 3.5 in) and voltage of 110 volts. The specimen shall be a cube of side 90 mm (3.5 in), and shall be prepared by applying foam between the electrodes.
- 6.2.4 WATER DRAINAGE - Prepare a cavity approximately 2440 x 400 x 90 mm (8 ft x 16 in x 3.5 in) from wood and plywood. Fill the cavity by foaming in place or trowelling. Leave the cavity with the long dimension in a vertical position for 24 h, during which time the bottom and underside of the wooden structure are examined for water. The cavity shall be built such that any free water from the foam can easily run out at the bottom.
- 6.2.5 SHRINKAGE DURING CURING - Fill three cavities each measuring 480 x 480 x 90 mm (18 x 18 x 3.5 in) made from wood and plywood with foam. *Maintain the* cavities with the long dimensions in a vertical position for 28 days at 23±2°C (73±4 F) and 50±5% RH. Then open the cavities and measure the linear shrinkage in the two principal directions. Report the average of all six determinations as the linear shrinkage. If fractures in the specimens occur, the data should be discounted and the test repeated.
- 6.2.6 FUNGI GROWTH INHIBITION - Prepare two test frames, measuring 480 x 480 x 90 mm (18 x 18 x 3.5 in) from Douglas Fir plywood and white spruce. Submerge test frames in tap water for 48 h. Remove the test frames and dry the surface with paper towel. Drill a hole in one test frame and foam in the material under test. *Maintain the* two test frames in a vertical position for 28 days at 23±2°C (73±4 F) and 50±5% RH. *Then open up* both test frames and remove and examine the cured foam. Determine the area of fungi growth in the control and in the specimen test frame.

6.2.7 THERMAL RESISTANCE - The thermal resistance shall be determined as specified in ASTM C 177, ASTM C 518 or ASTM C 236, using a specimen 75 mm (3 in) thick, tested with a mean temperature differential across the specimen of 22+30C (72+5 F). In cases of dispute, ASTM C 177 or ASTM C 236 shall be used. Specimen surfaces may be those obtained during foaming or they may be obtained by slicing the material to remove not more than 5 mm (0.2 in) from each side.

6.2.8 CORROSIVENESS

6.2.8.1 Apparatus and Materials

a) An oven capable of maintaining 50+20C (122+4 F) and another oven capable of maintaining 70+2 (158+4 F).

c

b) A small container approximately 70 x 50 mm (3.5 x 2.0 in), made of inert material such as polypropylene and equipped with a lid so designed that water condensing on it will not drip but will run to the walls of the container.

c) A large container capable of housing the small container in item (b) but which will fit inside the oven.

d) Metal test specimens, approximately 50 x 50 mm (2 x 2 in) by 0.08 mm (0.003 in) thick free of tears, punctures or crimps as follows:

i. 3003 bare aluminum

ii. ASTM B 152, type ETP, Cabra No. 110, soft copper

iii. low carbon, commercial quality, cold rolled, shim steel

e)
Test specimens, section of truss plates approximately 50 x 50 mm (2 x 2 in) by 1.0 mm (0.04 in) made from hot dipped galvanized sheet-steel conforming to Grade A or 8, ASTM A 446 with a total zinc coating of 275 -0, +31 g/m² (0.91 -0+0.1 oz/ft²). At least 40% of the zinc shall be on any one side of the test specimens. Test specimens shall have at least 6 perforations.

Trichloroethylene, analytical reagent grade.

9) Balance, capable of determining the mass of the galvanized specimen to an accuracy of 1 mg.

h) 40 -R appliance light bulb.

I Distilled water, nitric acid 15.9 N, ammonium hydroxide (sp gr 0.90), chromium trioxide, silver nitrate, hydriodic acid, reagent grade chemicals.

j) Several non-corrosive plastic supports and a 150 g (0.331b) mass.

6.2.8.2 Specimen of Insulation-Materials

A representative sample of the insulation material shall be submitted for test, portions of which shall be used for each test.

6.2.8.3 Procedure

6.2.8.3.1 Make two replicate tests for each determination.

6.2.8.3.2 Wash the metal specimens with trichloroethylene to remove any oil or grease. Dry at room temperature.

- 6.2.8.3.3 Prepare foam, specimens from blocks obtained from the test in par. 6.2.5. Cut a specimen 60 mm x 60 mm (2.4 x 2.4 in) square and 15 mm (0.6 in) thick from the block such that one of the 60 x 60 mm (2.4 x 2.4 in) surfaces is that obtained from foaming and not slicing the foam. All other surfaces of the specimen shall be obtained by slicing the foam. Compress the specimen between flat, parallel, non-corrosive plastic surfaces for 2 min at 700:±70 kPa (102 ±10 psi) to form wafers. Prepare 16 such wafers, noting which surfaces had been obtained from foaming. These surfaces shall be placed adjacent to the metal specimens in the tests.
- 6.2-8.3.4 Weigh the galvanized specimen and record its mass.
- 6.2.8.3.5 Place a non-corrosive plastic screen support in the small container. Place a foam wafer on the support at least 5 mm (0.2 in) above the bottom of the container. Place the metal specimen on the wafer; put another wafer on the metal specimen and then place on top of the sandwich a non-corrosive plastic screen and the 150 g (0.33 lb) mass. The 150 g (0.33 lb) mass shall not block airflow to the top wafer. Cover with the lid of the small container such that the container is closed but not sealed.
- 6.2.8.3.6 Place the small container in the large container, add sufficient distilled water to the large container and close the large container but do not seal it..

- 6.2.8.3.7 Place the assembly in an oven at 70±2°C (158±4 F) for 24 h.
- 6.2-8.3.8 Remove the assembly from the 70°C (158 F) oven, seal the large container and transfer the assembly to an oven maintained at 50±2°C (122±4 F). Maintain the assembly at this temperature for 28 days.
- 6.2.8.3.9 Upon completion of the test remove the assembly from the oven and dismantle. The large container shall still have some water in it; if there is no water present at the end of the test, then results for those materials passing the test are suspect and the test should be repeated.
- 6.2.8.3.10 Thoroughly wash the metal specimens under running water and lightly brush them to remove loose corrosion products. Remove the remaining corrosion products from the aluminum, copper and steel specimens by immersing them in a solution of 10 parts distilled water to 1 part 15.9 N nitric acid. Remove the remaining corrosion products from the galvanized specimens by the procedure recommended in ASTM G1 in the method for the chemical cleaning of zinc after testing. Rinse all metal specimens in distilled water and dry
- 6.2.8.3.11 Examine the aluminum, copper and steel specimens over a chrome-reflected, 40 W appliance bulb for perforations.
- 6.2.8.3.12 Examine the galvanized specimens for pitting and weigh the specimen and its **control**. The **control** shall be a specimen having the same number of perforations, be of the same geometric form and be of the same batch of truss plates as the specimen. The control shall not be exposed in the oven but shall be cleaned identically to the specimen. Subtract the loss in mass of the control from the loss in mass of the specimen.

6.2.9 WATER ABSORPTION

6.2.9.1 FLOATING TEST

Cut three cubes, each 180 x 180 x 180 mm (7 x 7 x 7 in) from a block of foam. Accurately weigh each cube and place it on a distilled water surface. After 7 days at 23+2°C (73+4 F) and 50+5% PH, remove the cubes and accurately weigh them. Calculate the percentage water absorption on a volume basis. The surface in contact with the water shall be that obtained from foaming.

6.2.9.2 DROPLET TEST

Prepare a 3% solution of methyl violet in distilled water. Apply 5 drops, each 0.03 ml, of the solution by means of a syringe to a freshly cut horizontal surface of the foam and to a surface obtained from foaming. Measure the time required for the drops to be completely absorbed through the surface of the foam. This point in time may be ascertained under direct lighting as the moment when the area to which the drop has been applied becomes dull. Perform the test at 23+20C (73+4 F) and 50% PH.

6.2.10 SURFACE BURNING CHARACTERISTICS.- The flame spread classification* shall be determined according to ASTM E 84 on a specimen at least 50 mm (2 in) thick. The surface tested shall be that obtained from foaming.

ASH CONTENT --A-foam specimen of known volume is placed in a muffle furnace at ambient temperature. The temperature of the furnace is raised to 950+50-C (1740+90 F) and maintained at that temperature for 16 h. Upon cooling the specimen, the volume of the ash is measured, and calculated as a percentage of the volume of the original foam specimen.

*Values of flame spread classification are not intended to reflect hazards presented by this or any other material under actual fire conditions.

7. ADDITIONAL REQUIREMENTS AND NOTES

7.1 *RE)QUIMENTS* - The following requirements in this bulletin should be specified in its application:

- a) The application procedure (par. 7.2).
- b) Resistance to combined high temperature and high humidity (par. 7.3.2).
- c) The effective thermal resistance required (par. 7.3.3).

7.2 APPLICATION - The material shall be installed in accordance with the manufacturer's specific instructions and the general guidelines given in par. 8. Manufacturers shall provide to their distributors or applicators a copy of their instructions for application.

7.3
INTENDED USES

- 7.3.1 The material is intended for use as thermal insulation in walls of building **constructions**, and is accepted for use only in enclosed building cavities such as walls, partitions and floors.
- 7.3.2 Resistance to combined high temperature and high humidity - Available research data have indicated that the stability of urea-based foam insulation may be suspect when the material is subjected to an environmental condition of combined high temperature and high humidity. The foam insulation should not be applied in areas which experience prolonged periods of high temperature and high humidity. Since prolonged periods of high temperature and high humidity may be encountered in attics and ceilings, urea-based foam insulation shall not be applied in these locations.
- 7.3.3 Effective thermal resistance - Data gathered from limited field observations of urea-based foam insulations in building **constructions** have shown that shrinkage of foam insulation has been between 1 and 11 percent on a linear basis after installation. These data suggest that the average linear shrinkage of the foams is about 6 percent. Because of shrinkage a reduction in thermal insulation ability of installed foams is anticipated. The thermal insulating ability

of installed foams is herein referred to as the effective thermal resistance. The effective thermal resistance of foam installed in empty cavity walls shall be determined according to the method described in par. 7.3.3.1 or 7.3.3.2.

If the average percent shrinkage of the foam expected to occur in building constructions over a period of at least 2 years has not been established, then the average expected shrinkage of 6 percent shall be used to determine the effective thermal resistance. In this case the effective thermal resistance of the foam is 72 percent of the thermal resistance that would be obtained on a laboratory specimen of the same thickness as that of the cavity. The effective thermal resistance value may be calculated from the following:

$$\text{effective thermal resistance (m}^2 \cdot \text{C/w)} \\ = R \frac{(\text{m}^2 \text{ C/w})}{7510} \times T (\text{m}) \times .72$$

$$\text{effective thermal resistance (ft}^2 \cdot \text{h} \cdot \text{F/BTU)} = R (\text{ft}^2 \cdot \text{h} \cdot \text{F/BTU}) \times T (\text{in}) \times \frac{72}{300}$$

where T = the thickness of the cavity.

R = the thermal resistance of the foam determined in accordance with par. 6.2.7.

NOTE: A 3 inch specimen is used in par. 6.2.7 test. Thus 3 x 100 (300) in formula reduces the result to proper units and percentage, respectively.

7.3.3.2 If the average percent shrinkage of the foam expected to occur in building construction over a period of at least 2 years can be established by the manufacturer or the Department of Housing and Urban Development this value of average percent shrinkage may be used to determine the effective thermal resistance., The percent reduction in the thermal insulating ability of the installed

foam Corresponding to the established percent shrinkage is illustrated in Figure 1. In this case, the effective thermal resistance of the foam can be determined by using the reduction factors corresponding to the percent shrinkage given in Table 1 and is calculated from the following:

effective thermal = $R(\text{m}^2 \cdot \text{C}/\text{W}) \times T (\text{cm}) \times \text{RF}$
 resistance ($\text{m}^2 \cdot \text{C}/\text{w}$)

effective thermal = $R(\text{ft}^2 \cdot \text{h} \cdot \text{F}/\text{BTU}) \times T (\text{in}) \times \text{RF}$
 resistance $\sim (\text{ft} \cdot \text{h} \cdot \text{F}/\text{BT} \sim) \quad 300$

where T = the thickness of the cavity.

R = the thermal resistance of the foam determined in accordance with par. 6.2.7.

RF = the reduction factor corresponding to the average established percent shrinkage given in Table 1.

7.3.3.3 For application where the foam is installed in cavity walls already containing a mineral fiber batt against one wall, shrinkage of the foam is also anticipated to reduce the expected thermal resistance of the resulting insulation system. The effective thermal resistance of this insulation system is not determined at this time.

The Publications identified in par. 2.1. 1 are available from the American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.

The Publication identified in par. 2.1.2 is available from the National Fire Protection Association, 470 Atlantic Avenue, Boston, Massachusetts 02210.

8 GENERAL GUIDELINES FOR APPLICATION - Each manufacturer's recommended set of application instructions differs slightly from those of the other manufacturers because of the variations in foam formulation and differences in design of the gun for applying the foam. It is not feasible to recommend a detailed set of application guidelines that * would be universally applicable to each of the urea-based foam system which are currently available in the* United States.

This section presents a general set of guidelines to assist contractors, inspectors and users in ascertaining that the proper application Procedures and certain safety precautions are being followed. These general guidelines should be used in conjunction with the manufacturer's specific instructions for application (par. 7.2).

The general set of guidelines includes:

Foam installation Should be performed by an applicator who has been trained or approved by the foam manufacturer. Installation by an inexperienced applicator may result in an unacceptable foam which may perform poorly.

Foams shall not be applied in ceilings or attics (par. 7.3.2)

Foams shall not be applied in exposed applications (par. 3.3). U.S. Model Building Codes require that all foam plastics used on the inside of buildings in walls be protected by a thermal barrier of fire-resistive materials having a finish rating of not less than fifteen minutes. In addition, exposed urea-based foams may be subject to photodegradation.

Prior to the application of foams in warehouses or similar buildings where foodstuffs may be stored in the open, it should be determined if this type of application presents a safety hazard. Possible safety hazards presented by the application of foams to buildings which store foodstuffs in the open have not been addressed in this bulletin.

Foaming equipment should be kept clean and well-maintained. Manufacturers have cleaning and maintenance recommendations for their equipment.

Dates after which the resins and foaming agents are not usable should be clearly labeled on the resin and foaming-agent containers (par. 5.1.2). These dates (or shelf-lives), as recommended by the manufacturers, should never be exceeded.

The resins and foaming agents should be stored within the temperature range recommended by the manufacturer. Some U.S. manufacturers have recommended that 21°C (70 F) is the maximum storage temperature for their materials. The Canadian Government Specification Board has proposed a storage temperature range of 10 to 30°C (50 to 86°F). In general, as the storage temperature is increased the shelf-life is shortened.

The temperature of the resins and foaming agents as they enter the foaming gun should normally be within the range of 15 to 30°C (59 to 86 F) unless otherwise specified by the foam manufacturer. One U.S. manufacturer recommends that his materials enter the gun at temperatures not less than 21°C (70 F). The maximum temperature of 30°C (86 F) should never be exceeded. For cold weather applications, the resins and foaming agents should be kept in a heated area (normally the applicator's van) during foam production and the supply-lines from the storage containers to the foaming gun may have to be insulated.

The temperature of the exterior surface of the cavity in which foams are to be applied should be within the range of -5 to 30°C (23 to 86 F). It is recommended that these temperature limits should not be exceeded for a period of four days after application.

S The resins and foaming agents should be pumped to the foaming gun at pressures recommended by the foam manufacturers.

S Power lines in excess of 200 volts within cavities in which foams are to be applied should be shut off until the foams have dried or until the cavities are sealed.

S Power lines in excess of 110 volts within cavities in which foams are applied should be shut off during application if foaming is performed with the applicator standing on wet ground or not electrically insulated from wet ground.

The appearance of the foams should be checked immediately before application. The foams should be fluffy with a warty surface. When the foams are sliced, the cells should be uniform.

The setting time of the foams should be determined before application and should be no less than 20 seconds and no longer than 60 seconds for application into closed cavities, and no less than 10 seconds and no longer than 60 seconds for applications into open cavities (par. 4.2.1).

The wet density of the foams should be determined before application and should lie within the manufacturer's specified range for the wet density. The nominal wet density of the foams is approximately 40 kg/m³ (2-5 lb/ft³). Wet density is measured by filling a container of known weight and volume and then weighing the filled container.

If the foams are inadvertently sprayed on aluminum build in components such as door frames, window frames, or awnings, the foams should be removed immediately and the aluminum component should be rinsed thoroughly with water. In cases where it is anticipated that an aluminum component may be sprayed during application, the component should be protected before application begins.

Foams which are sprayed on glass should be removed by rinsing with water.

Water present in the foams at application should be permitted to escape from the wall while the foams dry in the cavity. In cases where the two wall surfaces may restrict the water vapor transmission, the foam should not be applied unless provisions are provided to allow the water in the wall to escape.

9.

A vapor barrier is required for all new construction in accordance with the Minimum Property Standards. In applying the insulation in exterior walls of existing homes which are located in geographic locations having long cold winters, consideration should be given to applying a vapor barrier on the interior (warm side) surface of the wall. The absence of the vapor barrier on the interior of the insulated wall may cause condensation and the accumulation of excessive moisture within the wall. This may lead to problems such as blistering and peeling of paint, buckling of wood siding or in extreme cases, rotting of wood members within the wall. A vapor barrier may be created by applying a low permeability paint or vinyl wallpaper to the surface of the interior wall.

In retrofitting the walls of residences with any type of insulation, if the need arises to verify the completeness of filling the wall cavities, one method which can be used is infrared thermography.

CERIFICATION

Each manufacturer shall certify that his approved applicators of urea-based foamed resin insulation are licensed as such and carry a current certificate of qualification and an identification card.