The enclosed specifications are designed to summarize the activities and responsibilities of all the principal parties to a roofing project. Oftentimes, the guide specification will function as the primary bid document when authorizing a roofing contract. These detailed instructions are intended to govern both the application itself and the process of awarding the work and issuing a warranty. Since no two roofs are exactly alike, further adjustment of the specification may be required. The enclosed guide specifications are typically used as a model for initial review purposes, then customized with Truco personnel prior to the solicitation of bids.

POLYURETHANE FOAM INSULATION

PART 1 GENERAL

1.01 DESCRIPTION

A. This section describes the requirements for furnishing and installing a monolithic, insulated, fire resistant roof covering system which meets the Class A non-combustible deck requirements under ASTM E-108/UL 790. Suitable substrates include concrete, poured gypsum, metal and certain heavy wood decks. For re-roofing over BUR or other roof covering materials, a system applied according to this specification will not alter the existing fire resistance rating. Surfaces to receive the roof covering system must meet requirements of applicable building codes and structural design.

B. Spray-in-place polyurethane foam is applied at a desired thickness (1" minimum) to fulfill thermal insulation requirements and to provide a seamless, monolithic surface over a wide variety of roof designed shapes and draining slopes.

NOTE: The Truco, Inc. coating system will provide the best long term protection for the insulation when there is no ponding water. The deck shall have at least a ¼" to the foot slope for drainage to avoid ponding water. Ponding water is defined as standing water in excess of 100 square feet with a maximum depth of ½" deep which does not evaporate within 72 hours after a rainfall. The thickness of the foam insulation can be varied to provide slope to a degree and build crickets in corners and fill low areas. The appearance of the system depends on the finished surface of the foam insulation, which normally has slight undulations in thickness and will follow the contour of the substrate and will reflect projections and depressions.
The Truco Rubber elastomeric coating systems discussed in this specification have a moderate rate of water vapor transmission and are not recommended for use on cold storage or cryogenic structures. Such structures may have constant high water vapor drive causing long term accumulation of moisture in the insulation. Consult Truco, Inc. for vapor retardant systems to use on refrigerated structures.

C. Scope of Work: Provide all labor, materials and equipment necessary to complete the polyurethane foam roofing system as indicated on the drawings and specified herein. Principal items of work include, but are not limited to:

1. Preparation of all surfaces to receive work under this section, including all required inspections to determine possible moisture content in the existing substrate. Areas identified in the existing substrate as being wet shall be removed and replaced before the installation of the polyurethane foam roofing system. Contractor bidding work shall include price of removal _____ per square foot in bid: The cost removal, If more than _____ square feet are to be removed, an additional charge of _____ per foot will be charged, If less than _____ square feet are to be removed, a deduct cost of _____ will be credited back to the owner.

2. Furnishing and application of designated thickness of the spray-in-place polyurethane foam insulation and type of coating system to a finished dry mil thickness of 32 mils.

D. Definitions:

COATINGS

1. P.D.S. Product Data Sheet - describes the product, its intended usage and how it should be used and applied, the physical and mechanical properties of the product before and after application.

2. M.S.D.S. Material Safety Data Sheet - describes the composition, stability and reactivity, hazards identification, first aid measures, toxicological information, personal protection, fire fighting measures and storage and handling.

3. Single Component - It is a mixture of reactive materials, which will cure without the application of a co-reactor or catalyst, to give final product.

4. Plural Component - It is a product consisting of at least two reactive materials, which when mixed together, form a cured polymer.

5. Moisture Cure - Moisture Cure systems depend on water to initiate the reaction between reactive materials.

6. Aliphatic - A class of organic compounds or products containing no aromatic (benzene rings, etc.) segments into their chemical structures. They tend to have excellent UV and color stability.

7. Aromatic A class or organic compounds or products containing aromatic groups such as benzene rings in their chemical structures. They tend to be less stable for UV resistance.

8. Acrylic - A class of reactive organic compounds or products. Their reactivity is based on the acrylic functional groups. They can be water-borne or solvent based. They are made by polymerization of acrylic or methacrylic acid derivatives.

9. Latex - A generic term describing a water suspension of a natural or synthetic rubber-like resin.

10. Epoxy - A class of reactive organic compounds or products when properly catalyzed can react with themselves or with other reactive systems such as polyols, polyacids, etc. to produce thermoset polymers.

11. Silicone - A class of products that contain the silicone atom in their structures. They can be inorganic in the form of silicone dioxide (silica), or organic when they are part of the molecule (silicone rubber).

12. Hypalon - It is a series of chlorosulfonated polyethylene synthetic rubber products manufactured by the DuPont Company.

13. Polyurethane Foam - A cellular plastic that is obtained by forming gas bubbles in the polymerization reaction of polyols and isocyanates.

14. Poly Side - A description for the part that contains the alcohol groups in polyurethane synthesis.

15. Iso Side - A description for the part that contains the isocyanates groups.

16. Batch Mix - A process where the slower reacting poly side and iso side is mixed together in a container manually before either spray or roller application.

17. Fast Set - A quick polymerization of a two-part polyurethane system requiring application with two-component spray equipment. Cure can be in the range of seconds.

18. 100% Solids - A description of the reactive coating systems that have no solvents (V.O.C.'s - volatile organic compounds) in their formulations.

19. A Square - A unit of area 10' by 10' or 100 square feet.

20. A.S.T.M. - American society of Testing and Materials. An organization, which sets formal test procedures for, standardized evaluation of physical systems.

21. Tensile - The maximum stress a material can withstand before rupture, usually expressed in pounds per square inch.

22. Elongation - The maximum extension of a material at the point of rupture.

23. Permanent Set at Break - The extent to which a sample remains elongated after stretching to the breaking point, expressed as a percentage of the original length.

24. Hardness - The ability of a material to resist indentation when a force is applied over a small area.

25. Shore A - A standardized instrument, the durometer, is used to measure the hardness of rigid, plastic-like materials. The test procedure is listed as ASTM D-2240.

26. Tear Resistance - The force required ripping a film sample, usually expressed in pounds per lineal inch.

27. Water Absorption - The amount of water a material will assimilate after immersion for a specified length of time, expressed as a percentage of the original weight.

28. Water Vapor Permeability - A measure of the ability of water in gaseous form to pass through a specified thickness of a given material.

29. Perm Inches - A way to express water vapor permeability in terms of a reference value of 1 inch.

30. Coverage (ft2/gal/mil) - The number of square feet a gallon of liquid coating will cover to a cured thickness of one, one-thousandth of an inch. Dependent on the coatings percentage volume solids.

31. Solids - That part of a liquid which is not volatile, i.e. will not evaporate. Can be expressed in either percent by weight or volume.

32. A.P.C. - Air Pollution Control. A general reference to regional or national laws, which may prohibit the usage of certain coatings due to excessively high levels of V.O.C.'s.

33. Mil - One, one-thousandth of an inch.

34. Vapor Drive - The characteristic of water vapor to migrate from warmer to cooler areas.

35. Vapor Barrier - Any material that does not allow the passage of water vapor through itself.

36. V.O.C. - Volatile Organic Compound. Primarily solvents which have been found to contribute an air pollution after evaporation into the atmosphere.

37. Flash Point - The temperature at which a liquid will give off enough flammable vapor to ignite in the presence of an ignition source.

38. Pot Life - After mixing, the length of time a two-part system will remain low enough in viscosity to remain workable.

39. Tack Free - That point in the curing process at which the surface no longer exhibits adhesive-like stickiness.

40. Cure - The chemical process, which transforms a system from the liquid to the solid phase.

FOAM

41. Nominal Density - Average weight per unit volume, usually expressed in pounds per cubic foot.

42. K Factor Aged - A measure of resistance to heat transfer performed on a foam sample, which is fully cured, and at equilibrium. The inverse of the R value. Expressed in BTU in/ft2 hr. ºF.

43. Compressive Strength - The maximum force supported by foam at up to 10% deformation, usually expressed in pounds per square inch.

44. Shear Strength - The maximum force required to fracture a foam when opposite and parallel forces are applied at the top and bottom of the sample. Measured in P.S.I.

45. Closed Cell Content - The percentage of cells in foam, which are completely enclosed by a continuous membrane and interconnecting, structures.

46. E-84 - A standardized fire test performed in a burn tunnel and used to determine the flammability of polyurethane foam.

47. Class I - The highest rating assigned to polyurethane foam indicating it meets the most stringent requirements for fire resistance.

48. Class II - An intermediate foam rating with less severe requirements than Class I.

49. Class III - The lowest fire rating which is assigned to foam with minimal fire retardancy.

1.02 RELATED WORK SPECIFIED ELSEWHERE

A. Cast-in-place concrete: Section 03300

B. Flashing/Sheet Metal: Section 07600

C. Roof Accessories: Section 07800

1.03 SUBMITTALS

A. Submittal Package Submit Manufacturer's literature, certificates, samples (cured 6", by 6" sample of the total system) daily quality report form and copy of 10-Year System Warranty.

1. All required submittals shall be presented to the owner's representative for review in a single package.

2. All required submittals shall be accepted up to the date of the mandatory pre-bid conference. Any modifications or exceptions to the requirements of this specification shall be forwarded to the owner's representative in a letter of transmittal before the pre-bid conference. Otherwise, all requirements shall be as specified and shall be adhered to.

3. Manufacturer's literature: Manufacturer's literature, technical data, application instructions and product data sheets shall be presented in the submittal package.

4. Products utilized shall be supplied and warranted under a single source manufacturer such as Truco, Inc., or Approved equal.

5. Contractor's Certificate: Submit a copy of Approved Applicators' certificate asissued by the manufacturer. This certificate shall be in force before date of contractor's bid due.

6. Warranty: Submit a copy of manufacturer's warranty Submit UL 790 test results for the Class A System involving the sprayed-in-place polyurethane foam roofing system.

7. references: Bidders are to submit a list Have completed projects of equal size. Listing to include date of completion, contact person, size of project and the telephone number. Listed projects shall have been completed a minimum of 3 Years prior.

1.04 QUALITY ASSURANCE

A. Primary insulation and waterproofing materials shall be provided by a single source Manufacturer. Secondary materials shall be recommended and approved by the primary Manufacturer. Primary manufacturer shall have a minimum of 10 years experience in the manufacturing of type of materials specified.

B. Contractors shall have a minimum of 5 years experience in the applications of materials specified and 10 years experience in the installation of the sprayed-in-place polyurethane foam roofing system.

C. Pre-bid conference: All prospective bidders and material manufacturer's representatives are required to attend a pre-bid walk through of the specified project. Date and time of conference shall be established by the owner's representative and shall be a minimum of 10 working days before the bid opening date.

1. Any products submitted other than what has been specified, as approved equal shall be submitted at this time only. Products accepted, as equal shall be verified in writing before bid opening.

2. Any bidders not participating in the pre-bid conference will cause their bid package to be invalid at bid opening.

D. Qualifications of foam/coating contractor:

1. The polyurethane foam insulation and protective coating system shall both be applied by a single contractor who shall meet the following requirements:

a. Mechanics applying the specified system must have prior experience in the handling and spraying of type of materials specified and spray equipment and must operate under direct supervision of approved contractor.

b. Contractor shall be an approved applicator of roof's system manufacturer.

2. The application request for warranty must be completed, filed and approved by the system manufacturer before commencement of work.

E. Container Labels: Include the following on label of each container: Manufacturer's name, product name, type and class of material, UL Classification issued number, batch or lot number, date of manufactured products with limited shelf life, mixing instructions and precautions. The manufacturer as per must certify any bulk materials previously specified.

F. Inspections: Field Quality Control:

1. Substrate inspection: The contractor, owner's representative and the manufacturer's representative shall jointly inspect the project before the application of any material. This inspection shall verify surface preparation as properly being completed and meet the guidelines of manufacturer's roofing system. If any deficiencies exist, the contractor shall correct noted defects as directed by the manufacturer and an additional inspection shall be conducted to verify compliance.

2. Foam Substrate Inspection: Prior to the coating application, an inspection by the manufacturer's shall be conducted to verify proper slope to drain, surface uniformity and texture and terminations have been properly completed. Should any defects be noted, an additional inspection is to be conducted to verify corrections.

3. Application Inspection: During the initial coating applications, the manufacturer's representative must be present during application to verify compliance with established specification guidelines. If any noted defects exist, the contractor is responsible to correct noted defects and a follow-up inspection shall be conducted to verify corrections.

4. Final Inspection: the contractor, manufacturer's representative and owner's representative shall make A final inspection. Points of verification of this inspection include proper drainage, treatment of details, obtaining acceptable number of slit samples (1 per 5000 sq. ft with a minimum of 3 per roof), uniformity of applications, dry mil verification and approval of project as being acceptable for warranty status and photos. Should defects be noted, the contractor shall be directed to correct and a follow up inspection shall be made.

5. Daily Quality Reports: Daily quality reports shall be completed on a daily basis. Report shall include temperatures (ambient and substrate), weather conditions (wind speed, cloudy, sunny, rain, etc.).

1.05 PRODUCT DELIVERY, STORAGE AND HANDLING

A. Deliver only specified and approved materials to the job site.

1. Materials shall be delivered in sufficient quantities as not to cause delays in application of the roofing system.

2. Any damaged materials or materials not conforming to the specified requirements shall be rejected by the owner's representative. Rejected materials shall be immediately removed from the job site and be replaced at no additional cost to the owner.

B. The contractor shall be responsible for the proper storage and protection of all materials required. Do not store materials on the roof. Materials shall be protected from the weather and out of the direct rays of the sun. Materials shall be stored and handled conforming to the requirements of the manufacturer, applicable safety regulatory agencies, and town, state and federal.

C. All waste materials and debris shall be cleaned daily and placed in acceptable containers for removal from the job site.

1.06 JOB CONDITIONS

A. Environmental: Proceed with work only when existing and forecasted weather conditions will permit applications to be performed in accordance with the manufacturer's guidelines and printed instruction.

1. Air temperature and substrate temperature shall be within the polyurethane foam manufacturer's established limits for the type of foam formulation used (i.e. spring, summer, fall, winter).

2. Unacceptable conditions for spray application include: Surface temperature above 160°F, dew point is less than 5°F above surface temperature, surface moisture is present or in excess of 15% as verified by Delmhorst Model BD7 moisture detector, if R.H. is above 80%, if wind speed exceeds 15 mph (without use of wind screen).

B. Protection of building and occupants:

1. All surfaces not to receive system specified shall be protected from overspray hazard (i.e. windows, doors, exterior and vehicles. Protective coverings shall be secured against wind and shall be vented if used in conjunction with applications preventing collection of moisture.

2. Contractor is to post signs noting potential overspray hazard within 400' of applications.

3. All air intake ventilation equipment shall be turned off to prevent fumes from entering building.

4. Surfaces damaged during application shall be restored at no expense to the owner.

5. No smoking signs to be posted as mandated by local fire officials.

C. Substrate: Proceed with work as specified only after substrate construction, preparation and detail work has been completed.

D. Equipment: All equipment used during operations shall be located so as not to adversely effect the daily operations or endanger occupants, structure or materials on-site all spray equipment must be grounded during operations.

1.07 WARRANTY

A. The manufacturer shall supply a ten-year Full System Warranty upon the successful completion of the roofing system.

PART 2 PRODUCTS (Provided by a single source manufacturer)

2.01 Materials: Sprayed-in-Place Polyurethane Foam Insulation and Elastomeric Truco rubber Coatings.

A. General: Provide Truco's Seamless Sprayed-in-Place Polyurethane Foam Roof System including primer, polyurethane foam and elastomeric Rubber protective coating.

B. Primer: Consult Truco's technical department for appropriate primer if required.

C. Polyurethane Foam: Foam Enterprises Inc. foams depending on job requirements. UL 108 rated 2.7-3.0 lb. Density.

D. Elastomeric Base Coating: 2gals/sq #7141 Super seam sealer.

E. ElastomericTopCoating: 1.5-2gals/sq#7145FR finish coat.

F. Miscellaneous Accessories: All items incorporated into this system shall be compatible with and approved by the technical department of Truco, Inc.

G. Granules: Ceramic type #11 as manufactured by 3M.

2.02 PERFORMANCE QUALIFICATIONS

A. General: This entire system including all accessories shall be a seamless, insulated and waterproof roofing system designed for intended use. It shall meet the requirements of UL 790 Class A on non-combustible substrates. Normal weathering shall not adversely effect it or exposure to occasional foot traffic required for maintenance of roof mounted equipment. The service temperatures of this system shall range from -40°F to 200°F. It shall be tested by the manufacturer to show the following minimum physical properties.

B. Primer:
Property Test Method Minimum Value
Tensile ASTM D-412 2200
Elongation ASTM D-412 350%
Tear Strength ASTM D-624 155 pli
Hardness ASTM D-2240 80 Shore A
Water Absorption ASTM D-471 2.0%
Permeability ASTM E-96 0.2 perm in.
Volume Solids Calculated 30%

C. Polyurethane Foam: In addition to the following minimum properties the polyurethane foam insulation shall be designed for spray application resulting in high quality, rigid polyurethane under the prevailing application conditions. The blowing agent shall be HCFC as required by Federal regulations. Polyurethane foam shall be of the proper formulation (winter grade, summer grade or regular grade) to meet climatic conditions at the time of application. The ONLY approved foam shall be

Foam Enterprises FE 303.3.0HCPC
Property Test Method Minimum Value
Nominal Density ASTM D-1622 2.85-3.20 lbs/ft3
Closed Cells ASTM D-2856 95%
Compressive ASTM D-1621 48-65 psi
Shear ASTM C-273 45-55 psi
K Factor ASTM C-177 .135-.145 max.
BTU, in/ft2,hr,°F
Flammability ASTM E-84 <75 Flame Spread

D. Elastomeric Base Coating: Enter physical properties from product data sheets.

Property Test Method Minimum Value
Tensile ASTM D-412 1500 psi
Elongation ASTM D-412 600% @77F
300%@32F
Permeability ASTM E-96 0.2perms
Per cent of solvents Calculated 55

E. Elastomeric Top Coating: #7145 ETERNA-SEAL.

Property Test Method Minimum Value
Tensile ASTM D-412 200 psi
Elongation ASTM D-412 200%@77F
100%@32F
Permeability ASTM E-96 0.2perms
Per cent of solvents Calculated 42

PART 3. EXECUTION

3.01 INSPECTION/TECHNICAL ADVICE

A. Verification that substrate to receive specified system meets the following requirements.

1. Surfaces shall be dry, free of dirt, grease, latency, and loose gravel, release agents or other contaminants, which will interfere with total adhesion of the applied system.

a. Cleaning of the roof should be accomplished by using power vacuum equipment, power sweepers, air blowers, power washers or other suitable means. Note: appropriate course of cleaning shall not commence without prior approval from owner's representative.

2. All associated construction (i.e. drain installation, edge flashing, penetrations and mechanical apparatus) shall be completed before commencement of specified roofing system.

3.02 PRIMER

A. Appropriate primers are as follows:

1. Metal: A two component epoxy applied at rate of 250 sq. ft per gallon

2. Copper: A two component solvent based epoxy applied at rate of 300 sq. ft per gallon

3. Concrete: A single-component moisture cured polyurethane applied at rate of 400 sq. ft per gallon/A two component water based epoxy applied at rate of 250 sq. ft per gallon or as recommended by Manufacturer.

4. BUR: A single component moisture cured Polyurethane (when required) applied at rate of 300 sq. ft per gallon or as recommended by the Manufacturer.

NOTE: Appropriate primer shall be as specified and/or at the direction of the manufacturer's representative.

3.03 SPRAYED-IN-PLACE POLYURETHANE FOAM

A. Application

1. Install Foam Enterprises FE 303.30HCPC, in a thickness of _____ + ¼" (1" minimum required). Neatly terminate the sprayed-in-place polyurethane foam on all vertical surfaces, (i.e. pipe penetrations, vents, mechanical

equipment, parapet walls, etc.) a minimum of 3" or 2 1/2 times the specified minimum foam thickness. Example: If 1" minimum is specified, all vertical terminations shall have a minimum of 2.5" sprayed up onto the vertical surface and canted to the horizontal surface.

2. The foam spray application shall be limited to only that amount which can be completed to full foam thickness in one day and base coat applied.

3. The completed foam surface shall be smooth to orange peel in surface texture. Popcorn texture is not acceptable.

4. The completed foam surface shall be free of pinholes and "fisheyes" due to improper equipment calibration or climatic condition.

5. The polyurethane foam shall be sprayed in a manner to achieve a full and proper spray pattern. The foam application shall be applied in no less than ½" in thickness.

3.04 PROTECTIVE COATING APPLICATION

A. General: Protective coating systems shall be spray applied over all polyurethane foam surfaces in accordance with the manufacturer's printed instructions or as specified herein.

1. Surfaces to receive coating application shall be free of any degregated foam, overspray, grease, oil, dirt or other contaminants which will interfere with proper coating adhesion.

2. An additional layer of base coat shall be applied to surfaces adjacent to all edges, penetrations, drains and protrusions so as to insure that those areas have more than the minimum coating thickness specified.

B. Application:

1. Elastomeric base coating: On the same day as the foam application but no less than 2 hours after foam application, apply Truco's #7141 base coat at a rate of 1 gallon per 100 sq. ft. Base coating shall be applied in a minimum of 2 coats to achieve an average film thickness of 14 dry mils minimum. Additional coats required to achieve dry mils specified may be applied as sufficient dry time permits. Refer to manufacturer's product data.

C. Protective Elastomeric Top Coating: Before application, all cut-in of edges, drains, details are to be completed.

1. Apply_1_coat of Truco's #7145 at rate of +1.5 gallon per 100 sq. ft to achieve a nominal dry mil thickness of 12 dry mils, minimum. The final topcoat color shall be WHITE. Top coating shall completely cover base coat at specified dry mil thickness of specific coating system.

D. Optional top coat, granulated surface: For the purpose of improving the overall fire rating, increasing the surface tensile strength, improving surface evaporation of possible bird bathing, and additional enhancement of the overall astethics, the contractor will apply an additional 8mils OR 1.1gals. of the topcoat and into it, he will broadcast 20lbs per 100 sq.ft. of #11 Ceramic Granules.

NOTE: In all aspects of coating applications, contractor is required to estimate losses due to possible overspray, waste, foam texture and wind.