**Facility Planning & Control**

**3. INSTRUCTIONS TO DESIGNERS ‑ ROOFING SYSTEMS**

 **PREFACE**

These instructions apply primarily to low slope roofing defined as waterproof, membrane type roof assembly utilizing FPC approved type systems. For steep slope defined as a water shedding type roof assemblies such as metal standing seam and shingles clay tile and slate consult with FPC. For final selection of roofing systems, confer with FPC for preferences and other requirements. Roof decks with components such as cementitious wood fiber planks, wood plank, plywood, precast concrete panels, and lightweight insulating concrete assemblies shall be selected with coordination and approval of FPC.

Include on the covers of your project documents for the Construction Documents Phase submittal the Building name, Site Code number and State (Building) ID number. Provide the roof area drainage calculations.

**In Division 7, if applicable to the project, use the following criteria for the design and specifications of roofing systems:**

A. Select an energy efficient roofing system with a basic long life design providing for minimal maintenance requirements and costs. Utilize the following instructions and resource/reference material:

1. Provide a complete roof plan for each building for the User's files that can be reduced 50% and still be legible. Use AutoCad with hard copies provided showing, as a minimum, the following:

a) Building line and roof edge relation.

b) A modular grid or structural column grid with number and letter coordinates.

c) All HVAC penetrations, equipment, pipe and conduit curbs which shall be carefully coordinated with the mechanical layout, taking care not to allow penetrations of any kind or runs of pipes to be within a minimum of one foot from any edge, curb, expansion or control joint. Indicate walking surfaces around all of the equipment on the roof plans. The Designer must provide roof top ladder (re-roof) and penthouse or hatch accesses (new const).

1) For new construction, no rooftop air-conditioning, ductwork or cooling towers will be acceptable without prior written approval of FPC.

2) For reroofing, Designer shall confirm conditions (pull-test on lt. wt conc., etc.) and components of the roof deck and relative elevations of the roof areas, i.e. slopes, edges, drains, penetrations, etc. It is recommended that with some roofs, it is advantageous to have the roof surveyed to establish more precisely existing elevations for sloping and draining design.

d) Use symbols and keynoting to minimize notes on the plans, however referenced symbols or notes should appear on each applicable page.

e) Use ASHRAE Standards, IECC and NRCA Energy Manual to develop the R-Value for the building envelope in new work and in re-roofing projects.

f) Roof slope shall be provided by structurally sloping deck on new buildings. If the Designer believes that structurally sloping the deck is impractical, he shall consult with the Roofing Section via their FPC Project Manager and obtain their concurrence before proceeding with any other system. There shall be no visual evidence of standing water on the roof 48 hours after it stops raining. Designer shall decide between interior and peripheral drainage systems with concurrence of FPC and User.

g) For membrane roofing, if fasteners are required to secure roof insulation to the deck, fasten the first layer, and then adhere the remaining layers (polyiso & coverboard) thereafter. This in an effort to isolate the membrane from slight movement of the fastener heads, and to minimize the thermal break in the insulation caused by the fasteners. Always specify a minimum fastening and adhesion pattern per wind zone.

h) Provide a minimum of two (2) roof drains for each roof area not including overflow scuppers. Depending on roof size and configurations, provide two (2) overflow scuppers. Limit the maximum spacing of drains in any direction to 50 feet. For interior drainage systems , design roof slopes to drain water from elevated peripheral areas to roof drain units, which shall have flexible connections to the plumbing storm drainage system. Provide cleanouts which are readily accessible at interior floor levels. Contractor shall be responsible for and furnish the roof drain assemblies, including the actual connection to the storm drain line. Roof drain assemblies shall be connected to storm drain lines prior to flashing flanges of the units on the roofing. In peripheral drainage systems, design slopes so rainwater flows from elevated areas to peripheral low points, to scuppers, conductor heads or leaders on to gutters and downspouts mounted and attached to exterior building wall. In parapet walls, provide through-parapet scuppers positioned and designed to be not over 4" in height above finished roofing surface or not over the elevation of the roof beyond which a possible flooded roof deck could cause structural failure. Follow the instructions for the design of roof drainage systems in the SMACNA Architectural Sheet Metal Manual and calculate for storms which should be exceeded only once in 100 years that being the most stringent requirement. As code requires, confirm the number and sizes of roof drains required. Locate drains at the lowest elevation points of the roof. Avoid locating drains near columns, Bearing Walls and within 3 Ft. of Roof Edge. Irregularly shaped roofs with penthouses and other obstructions may require additional drains with cants for good drainage. Design penthouse roofs to drain the same as for the main roof. Provide saddles between drains and crickets on the high side of curbed openings or other obstacles to insure free flow of water around said obstacle.

Include notation which refers to mechanical drawings for plumbing connections.

i) Provide roof access as follows:

1) For new construction of multistory buildings, provide ready accessibility to roof area(s) from stair enclosure space(s), from penthouse(s) with hatch mounted on penthouse roof complete with vertical OSHA approved type ladder/attached telescoping rail for safe mounting to the roof/roofs. For buildings four stories or more in height provide roof hatch(es) complete with ladders as described above. Provide ready access for any additional changes in roof areas which vary in heights from 8" and greater and above at all other areas of building roofs. Provide lockable type equipment to prevent unauthorized access to roof areas.

2) For re-roofing, if no roof hatch exists, provide new hatch or exterior ladder(s) designed to prevent unauthorized access to the roof area/areas. Design the ladder top access and exit to prevent damage to roof edging or to parapet coping, roof base flashing or inside parapet wall finishes. Use roofing manufacturer's approved roof pads, i.e., 3' x 5' sizes. Every roof level shall be made accessible as described above.

3) All ladder design shall comply with all applicable codes.

j) Provide complete details for typical, atypical and/or unusual roof and building design conditions. Details shall be shown at a large scale and if conditions warrant, in isometric projection.

Details shall include, but not necessarily limited to, metal roof edging, roof edging joint covers, roof edging corners, transitions from expansion joint covers to roof edging, area dividers defined as separation of roof areas where building changes direction, or deck changes direction or construction, control joints defined as joints to relieve membrane stresses for roof lengths over 200 feet. Also, include details for expansion joints defined as through‑building expansion joints, roof access hatches with ladder details, exterior roof access ladders, skylights and clerestories, roof drains, roof overflow scuppers, hot and cold stacks, HVAC equipment curbs, pipe and conduit curbs, parapet wall and abutting building wall base flashing or counter flashing, parapet caps or copings with joint and corner details, gutters and downspout details. Check surface conditions for downspout discharge as with splash-pans or check for possibility of tie-ins with subsurface drain lines complete with catch basins as required.

1) For re-roofing projects, if available, CAD drawings may be furnished to Designer, of the roofing area/areas, or the moisture survey Non‑Destructive Evaluation (NDE) report with scale drawings showing all items/components existing on the roof area/areas. The information for the drawings and other pertinent information will be furnished at the Pre-Design Conference. Designer shall conduct a survey of the roof areas accompanied by the User contact person and the User Maintenance Superintendent to determine and agree upon which existing rooftop components have been abandoned or damaged and must be removed from the roof deck. These components may include, but are not necessarily limited to, skylights, plumbing vent stacks, gravity vent housings, power vent units, antenna, satellite dishes, wiring cables, and gas and/or conduit piping with curbs. It is preferable if the user agency can have their maintenance personnel remove them, if not the components shall be shown on the Construction Documents Phase plans and identified by note for removal in the work of the project. Condition of all existing roof drains are to be reviewed to determine if replacement is needed. Photographs shall be made by the Designer as a historical permanent record and for prevention of future misunderstandings. If any rooftop equipment units are to be temporarily removed for the reroofing work and later re-installed, a careful inventory of each unit shall be made for the project file, including photographs and written descriptions of the visual and operating condition of each unit. In the review process, the User will confirm the existing rooftop components to be removed. All items declared abandoned and no longer in use shall be permanently "x" marked with exterior yellow spray paint. The use of photographs on the drawings is approved and encouraged. However, per doc instructions care should be taken at doc facilities, to not have inmates in the photos.

2) Provide complete roofing system specifications for a minimum of two manufacturers (preferably 3-6 as is indicated in the state shingle & sbs documents) which shall include all work done by the Roofing Contractor to achieve an undivided and single source responsibility:

a) Specify completely the roofing system. If Manufacturer's names and numbers are used, the complete current descriptions and specifications shall also be given.

b) State the following on roof systems other than SBS modified Bitumen:

1) An approved manufacturer shall have been in business manufacturing in the United States a minimum of (5) five years and the roofing system specified has been applied for (5) five years in the same type climatic zone as the geographic location of subject project.

This office requests a list of qualifying applications that can be documented as having been applied and performing well. This office requests the performance records of at least 3 roofs with addresses, locations and telephone numbers of contact persons. This information will expedite FPC inspections of manufacturer's systems applications.

 2) Roofing Contractor shall have the highest level of certification issued as an approved applicator by the roofing system manufacturer prior to bidding and shall provide a letter stating such after bids are received and before a contract is executed.

2. In addition to the required State Codes, the following criteria is recommended:

a) The National Roofing Contractors Association (NRCA) publications:

1) "THE NRCA ROOFING AND WATERPROOFING MANUAL", current edition.

2) "Quality Control in the Application of Built‑up Roofing", current edition.

3) "Guidelines for Roof Mounted Outdoor Air Conditioner Installations", current edition.

4) "Roofing Materials Guide", one for low slope and one for steep slope roofs, current edition.

5) "ENERGY MANUAL", current edition. Provide R-values for existing systems and R-values for new systems. The required R-Values will vary and can be obtained from FPC Engineering.

b) The Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA), ARCHITECTURAL SHEET METAL MANUAL, current edition.

c) Underwriters Laboratories, Inc. (UL), "ROOFING MATERIALS AND SYSTEMS DIRECTORY", "FIRE RESISTANCE - VOL. 1 DIRECTORY", "FIRE RESISTANCE - VOL. 2 DIRECTORY.", and "BUILDING MATERIALS DIRECTORY", current annual editions. Use Class A fire rating unless directed otherwise by FPC.

d) Factory Mutual System (FM), meeting FM "Approval Standard, Class I Roof Covers Class Number 4470", current edition with current supplements and "Approval Standard, Class 1 Insulated Steel Deck Roofs. Class Number 4450" current edition with current Supplements. Design for wind uplift resistance according to applicable Loss Prevention Data Sheets and the current annual Approval Guide, with current supplements. Use current FM data for wind uplift pressure resistance for Class 1-90 Windstorm Classification, which will be required for all State owned building roofs.

e) American Society for Testing Materials (ASTM), current annual edition, including product association standards, e.g. those of (AAMA) American Architectural Manufacturers Association; and (ANSI) American National Standards Institute; (AISI) American Iron & Steel Institute; (CDA) Copper Development Association; (SPRI) Single Ply Roofing Association; (SPI-PFCD) Society of the Plastics Industry, Polyurethane Foam Contractors Division.

f) Miscellaneous publications not listed above are available through National Roofing Contractors Association (NRCA) "Publications and Audio Visuals Catalog".

g) MANUAL OF LOW SLOPE ROOF SYSTEMS, authors are C. W. Griffin and Richard Fricklas, obtainable from McGraw‑Hill Book Company available November, 1995.

3. Miscellaneous Criteria

a) Specify:

1) That as-built documents shall be furnished by the Designer and shall include plans with details, specifications, all change orders and certain shop drawings all of which shall be furnished before Final Acceptance to the User.

2) Depending on type roofing it is recommended to prime all surfaces of embedded metal which will directly receive roofing or roofing flashing. Use ASTM D-41 Asphalt primer, latest version.

3) In Quality Assurance Section or Paragraph, that the State has the right to sample ALL roofing products on site for testing by an accredited laboratory if deemed essential to do so and without advance notice.

4) In complying with Wind Uplift Resistance, specify for steep roofing design under shingles or metal roofing that a minimum of #30 felt be used, but all in compliance with selected manufacturers' recommendation and specifications. Reference NRCA Roofing Materials Guide for both low slope and steep slope roofs to check technical information, dates, etc.

5) Department preferences with reference to the specifications i.e. for sheet metals: Copper, Kynar 500 or Hylar 5000 finished metal , soft stainless steel, aluminum. In general, do not use galvanized metal, and if used, only where metal is not exposed to exterior elements and only with FPC approval. Do not use proprietary and specialized coatings without FPC approval. The Designer shall investigate product performance records and submit the documentation which shall, as a minimum, state the time-in-place, color retentions, impact resistance, etc.

4. ROOFING CONFERENCES are required to be called for and conducted by the Designer. It is recommended, depending on the size and scope of the project, that three (3) roofing conferences (Prelim./Pre-Const., Pre-Application, Final Inspection) are held. See Roofing Agenda for complete information.

B. Incorporate a statement in the Specifications that FPC may, at their option, select and employ at FPC'S expense:

1. A roofing systems Consultant to review the Construction Documents and/or perform surveillance during any installation of substrate, roofing, flashing and any other part of the total roofing system.

2. An independent roofing inspection service specializing in performing Non‑Destructive Evaluation (NDE), for moisture detection purposes, before the final acceptance of the roofing or before the end of the roofing Guarantee Period.

3. Have a full time representative on site during the roofing installation. Additionally, FPC will conduct a moisture survey using FPC's Roofing Section personnel and equipment prior to the Department's approval and acceptance of the roof.

C. State in the specifications that the representatives of the Designer, FPC, User, the General Contractor, the Roofing Contractor and Roofing Manufacturer's technical representative shall make inspections of the roofing system toward the end of the one (1) year warranty period and toward the end of the Roofing Contractor's two (2) year guarantee period. Further, the Roofing System Manufacturer's authorized technical representative shall inspect the roofing system near the close of the Manufacturer's Guarantee. A written report shall be submitted to FPC, with a copy to the User, by the Roof System Manufacturer's representative within seven days of each site visit.

The Roofing Contractor or Roofing Systems Manufacturer, as applicable, shall make approved repairs and/or replacements covered by the Guarantee. State that the project will not be accepted until the Roofing Contractor's Guarantee and the Roofing Manufacturer's Guarantee are both executed in strict accordance with the Contract Documents and data from below in these Instructions and have been submitted to and accepted by the Owner.

D. Include in specifications that "The roofing system product supplier shall furnish the Roofing Contractor with Material Safety Data Sheet/Sheets (MSDS), incorporating OSHA approved form, current edition." State that "Said sheets shall be available at the site at all times until project completion." A copy shall be filed in the project file with FPC.

E. The Designer shall carefully coordinate and cross reference his roofing system documents with the Mechanical and Electrical Engineers. For undivided responsibility, all work for the roofing shall be specified as a system and shall be performed by the Roofing Contractor who shall coordinate with and not infringe upon the traditional jurisdictions of other trades. Details which deal with roof penetrations, supports for mechanical equipment and other related details such as drains which will have an effect on the roofing system, shall be shown on the architectural drawings.

F. Specify that the Roofing Contractor shall submit to the Designer, in digital format, all roofing data, including manufacturer's catalogs/manuals of materials and accessories used in the Project, including manufacturer's guarantee and maintenance recommendations, for distribution to FP&C, User Agency, and Designer.

G. Roofing Contractor’s Guarantees

1. Standard "Roofing Guarantee" forms have been developed for your information and guidance in preparing the specifications for Capital Outlay construction projects.

**Form FPC‑R1**-----is to be utilized on projects where the Roofing Contractor acts as a Subcontractor to a prime General Contractor.

**Form FPC‑R2**-----is to be utilized on roofing projects where the Roofing Contractor acts and performs as the Prime Contractor.

**Form FPC-R3**-----is to be utilized on metal roofing projects.

2. The applicable guarantee form is to be made a part of the roofing specifications and bound with same in the specification manual. Additionally, paragraphs are to be inserted in the roofing technical specification section to convey the following intent:

a) The roof system and associated work shall be guaranteed against leaks from faulty or defective materials and workmanship for an applicable period shown on guarantee, starting on the date of FPC's Final Acceptance of the project.

b) The "Roofing Guarantee" shall be executed in duplicate, signed by the appropriate parties and submitted to FPC processed through the Architect.

c) Electronic signatures or copies shall be acceptable for the Roofing Contractor guarantee forms listed.

H. Roofing Manufacturer's Guarantee/Warranty

1. Metal Roofing Manufacturer’s Guarantee shall be provided using FPC’s **Twenty (20) Year Weathertightness Metal Roof System – Limited Warranty**.

2. Membrane Roofing Manufacturer’s Guarantee shall be provided using FPC’s Twenty (20) Year **Manufacturer’s NDL Watertightness Membrane Roofing System Warranty**.

3. Electronic signatures or copies shall be acceptable for Manufacturer’s Guarantee/Warranty.