MEMORANDUM FOR DISTRIBUTION

FROM: NGB/A7

SUBJECT: Air National Guard Engineering Technical Letter (ANGETL) 15-01-06, Roof Design Guidance

1. PURPOSE: To provide guidance in implementing the roof design policy.

2. APPLICABILITY: Mandatory requirements are defined in specific paragraphs and in referenced publications.

2.1. Effective date: Immediately.

2.2. Intended Users: Base Civil Engineers (BCE) and architect-engineering consultants (A-E).

2.3. This ETL shall be applicable for all new designs, designs for which NGB/A7O formal approval of the Type A-2 Concept Development Submittal has not yet been issued and for all code and criteria review. For projects that have obtained formal approval of the Type A-2 Submittal, application of this ETL shall be on a case-by-case basis and as directed by the NGB/A7O Project Manager.

3. REFERENCES: Refer to Attachment 1 for a list of referenced publications and active links, if available.

4. ROOFING GOALS, STANDARDS AND REQUIREMENTS:

4.1. ANG Direction: For all roofing projects, ANG policy prefers a steep slope standing seam metal roof (SSMR) as defined within the most current UFC. Roofing systems should be selected for lowest life cycle cost (LCC) with minimum maintenance. A steep slope SSMR shall be included in the LCC analysis. The A7O Program Manager will review proposed exceptions to the use of steep slope SSMRs and approve on a case-by-case basis.

4.2. Energy. Design per the most current standards for all new construction and all roof repair/replacement projects. To reduce heat island effect, the A-E shall design all roofs to "cool roof" standards per the ANGETL 15-01-01, Sustainable Design, Development, and Resource Conservation criteria for heat island effect – roof systems.
4.3. **Drainage.** Interior drainage systems are preferred over exterior drainage systems, especially in cold climates. Where exterior drains are expected to experience freezing weather, A-Es shall design them for maximum sunlight exposure and connection to below grade drainage system, where technically feasible.

4.3.1. Roofing design and drainage should prevent sheet flow from roofs onto any other surface where technically feasible and appropriate.

4.3.2. Interior drainage systems. Ensure that all drains move with the roof deck. Avoid placing drains close to columns, bearing walls or other supports. The ANG prefers cast iron manufactured drains. Avoid interior gutters.

4.3.3. Exterior drainage systems. Design a gutter’s highest vertical section at least 1 inch below roof height. When provided, A-Es shall design overflow scuppers in parapets to meet the latest code requirements.

4.4. **Penetrations.** Minimize roof penetrations to the greatest extent possible. Use wall penetrations instead of roof penetrations whenever possible. Require that all penetrations be trade coordinated. Center all penetrations for standing seam metal roofing systems on the roofing deck between structural members and roofing panel seams. Coordinate all penetrations on standing seam metal roofs to avoid penetrating the roof at a standing seam. Penetrations that do interrupt a standing seam shall have a manufactured curb or panel that integrates with the adjacent standing seams and provides the penetration flashing a flat surface on which to seal.

4.4.1. Equipment such as air conditioners, air-cooled condensing units, cooling towers and ductwork should not be placed on roofs to the greatest extent possible. Equipment that must be placed on the roof shall have equipment supports that penetrate the roofing system with round shapes (pipe penetrations). Tie all equipment supports into the roofing structure below the roofing system. Provide an independent equipment support structure above the roofing system attached to the pipe supports. Locate the equipment support system sufficiently above the roofing system to allow roofing system access for maintenance and replacement. Equipment shall be raised above the roof surface as indicated in the National Roofing Contractors Association (NRCA) construction details. Ensure that all equipment support penetration flashing extends to meet the minimal code and manufacturer’s requirement above the finished roof surface, and provide a manufacturer's standard galvanized umbrella cap with clamping band above the flashing system.

4.4.2. Antennas: Do not locate antennas on roofs. Provide wall-mounted antenna brackets that extend past the roof eave in lieu of roof-mounted antenna supports. Provide adequate communication conduit with weather-head access to all wall-mounted antenna brackets and/or roof areas for current and future communication
mission changes. The A7O Program Manager will review proposed exceptions and approve on a case-by-case basis.

4.4.3. Do not allow penetrations of any kind, or runs of pipes, within one foot of any edge, expansion joint or control joint. To ensure proper clearances between base flashing and penetration flashing, the minimum distance between penetrations, walls and parapets may need to be greater than 1 foot.

4.4.4. Maintain proper clearance between penetrations to allow flashing installation, and do not install penetrations in valleys or near drains or scuppers. Maintain a minimum distance of 1 foot between penetrations.

4.4.5. Use crickets, saddles and tapered edge strips to direct water away from penetrations and parapet walls. Provide twice the field roof slope to ensure these surfaces are sufficiently sloped.

4.4.6. Use flashing systems that can be maintained without disturbing adjacent building elements. Use permanently installed reglets and detachable counter-flashing for wall flashing (headwall and sidewall). Use permanently installed flashing with detachable counter-flashing for equipment curb flashing. Follow NRCA details for these flashing requirements.

4.4.7. All piping and conduit supports shall be the non-penetrating pillow block type or shall use support rollers specifically designed for this purpose and compatible with the roof system.

4.4.8. All piping and conduits that must penetrate the roofing system shall be provided with penetration flashing that extends to meet the minimum code and/or manufacturer’s requirement above the finished roof surface. Penetration flashing shall be provided with a manufacturer's standard galvanized umbrella cap with clamping band of the proper diameter above the standard roof flashing system.

4.4.9. Use of pitch pans or pitch pockets is prohibited. If unavoidable, discuss with NGB/A7O and allow provision of pitch pocket with metal covers in accordance with NRCA construction details. As an alternative, provide a metal umbrella cap (per NRCA detail) clamped to the penetration.

4.5. Roof Access. Provide access to all roof areas. Provide security to prevent unauthorized access to roof areas.

4.5.1. Interior Access. Wherever possible, provide access to roof areas from roof hatch with ladder (preferably from mechanical room or similar maintenance space) or stair enclosure with penthouse.

4.5.2. Exterior Access. After providing access to the lowest roof surface from the interior, provide access to higher roof areas, which are less than 25 feet above
adjacent surfaces, by providing a fixed exterior caged ladder. Design the ladder top to prevent damage to roof edgings, parapet copings, roof base flashing and inside parapet wall finishes when accessing the roof. Ladder design shall comply with OSHA and AFOSH safety criteria.

4.6. Photovoltaics (PVs). The design of the roof shall incorporate structural support and infrastructure where PVs can/may be located. The NGB/A7O Project Manager will review proposed exceptions and approve on a case-by-case basis.

4.7. Roof Warranty Plate. A warranty plate (stamped metal or engraved metal) shall be provided on the interior near the roof top entrance. The plate shall indicate the warranty period, roofing manufacturer, roofing installer, general contractor and date when the roof went into service.

4.8. Warranties. All roofing warranties shall be in accordance with UFC 3-110-03 for roofing.

5. ROOF CONSTRUCTION:

5.1. Preferred Construction. Standing Seam Metal Roof (SSMR). ANG policy is to use steep slope SSMRs (greater than 3:12) wherever practical and economical.

5.2. Alternate Construction. Whenever alternate roof construction is proposed, the use of low slope SSMR (3:12 or less, but no less than 1/2 inch per foot) is preferred wherever practical and economical. Where alternate construction other than low slope SSMR roofing systems is proposed, the following design criteria (and UFC) must be followed:

5.2.1. Do not introduce new membrane systems to the installation without consulting the BCE, The A-E shall provide the rationale for the selected system in the concept submittal.

5.2.2. Ensure the system to be specified is manufactured by firms having the experience, background and financial resources to meet the warranty provisions.

5.2.3. The designer must investigate and verify the availability of the specified system to the region of the project site.

6. ROOF REPAIR AND REPLACEMENT PROJECTS:

6.1. Existing roof composition, materials and attachment must be positively identified and their condition assessed for suitability to accept, and compatibility with, repair or reroofing materials to be used. Design field investigations may require destructive and non-destructive testing (e.g., core sampling, fastener pull tests, moisture survey and evaluation). Investigations shall identify existing system composition and thoroughly evaluate existing conditions, noting wet and damaged materials. All roof removal
projects shall identify compositions that contain asbestos and the corresponding specification shall address special handling procedures.

6.2. Do not design a new roofing membrane over an existing membrane system.

6.3. For reroofing work, final system selection must consider the interaction and relationship of roof and facility materials, characteristics, conditions, environment, ease of maintenance and LCC.

6.4. For roof replacement designs, ensure the existing structure in combination with the new roof system design can attain the required structural integrity, the specified fire rating and, where required, lightning protection.

6.5. Consider and address all existing roof equipment and materials, penetrations, parapet walls and thickness of existing insulation in the design of reroofing projects. If tapered insulation is to be used, determine how it will affect the existing penetrations, expansion joints, parapet walls, adjoining roof sections and roof-mounted equipment.

6.6. Always specify new metal in reroofing work, such as cap flashing, edge metal and drains.

6.7. Replace with new materials (e.g., membrane, insulation, etc) where conditions are deteriorated, where conditions will affect membrane warranty, or where the cost to remove and reinstall approaches or exceeds the cost of new installation.

6.8. Construction contract specifications shall require the contractor to notify the Contracting Officer when the existing roof system has been removed to allow time to conduct a full evaluation of decking before beginning placement of the new system.

6.9. Provide a design that clearly details installation requirements for flashing systems that can be maintained without disturbing adjacent building elements. Flashing systems shall use permanently installed reglet or base flashing and counter-flashing assembly with a detachable counter-flashing component. Follow NRCA typical details.

6.10. Existing pitch pans or pitch pockets that remain as a part of construction shall have new metal covers provided in accordance with NRCA construction details or shall have a metal umbrella cap clamped to the penetration.

6.11. Consider thermal efficiency of the building during design of roofing systems. Roofing design shall meet or exceed the requirements of the ANGETL 15-01-01, Sustainable Design, Development, and Resource Conservation.
7. **POINT OF CONTACT:** The point of contact for this ANGETL is Imad Andari, NGB/A7OT, imad.k.andari.civ@mail.mil, Comm 240-612-8770, DSN 612-8770.

\[signature\]

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Attachments:
1. Referenced Publications
2. Current ANGETL Index

Distribution:
Each USPFO
Each BCE