QA12 Maintenance Manual Submitted and Accepted

The Cx/QA process includes communication of activities that the owner will be responsible for completing in order to maintain the manufacturers' warranties (see "Suggested Commissioning Scope" in Chapter 2 for QA provider responsibilities). A copy of the OPR document should be provided to the operation and maintenance (O&M) staff for an understanding of how the building is intended to operate.

QA13 Resolve Quality Control Issues Identified Throughout the Construction Phase

Issues identified during the construction process are documented in an "issues log" and presented to the team for collaborative resolution. Issues are tracked and reviewed at progress meetings until they are resolved. Typically the CxA develops and maintains the issues log. Completion and acceptance of the systems and assemblies by the owner will be contingent upon what issues are still outstanding at the end of the project. Minor issues may be tracked by the owner's O&M staff, while other issues will require resolution before acceptance of the work. The Cx/QA process finishes with verification that the issues identified have been resolved. The owner provides direction to the team to resolve issues identified.

QA14 Final Acceptance

Final acceptance generally occurs after the Cx/QA issues in the issues log have been resolved, except for minor issues the owner is comfortable with resolving during the warranty period.

QA15 Establish Building Maintenance Program

Continued performance and control of O&M costs require a maintenance program. The O&M manuals provide information that the O&M staff uses to develop this program. Detailed O&M system manual and training requirements are defined in the OPR document and executed by the project team to ensure O&M staff has the tools and skills necessary. The level of expertise typically associated with O&M staff for buildings covered by this Guide is generally much lower than that of a degreed or accredited engineer, and they typically need assistance with development of a preventive maintenance program. The CxA/QA provider can help bridge the knowledge gaps of the O&M staff and assist the owner with developing a program that would help ensure continued performance. The benefits associated with energy-efficient buildings are realized when systems perform as intended through proper design, construction, operation, and maintenance.

QA16 Monitor Post-Occupancy Performance

Establishing measurement and verification procedures with a performance baseline from actual building performance after it has been commissioned can identify when corrective action and/or repair is required to maintain energy performance. Utility consumption and factors affecting utility consumption should be monitored and recorded to establish building performance during the first year of operation.

Variations in utility usage can be justified based on changes in conditions typically affecting energy use, such as weather, occupancy, operational schedule, maintenance procedures, and equipment operations required by these conditions. While most buildings covered in this Guide will not use a formal measurement and verification process, tracking the specific parameters listed above does allow the owner to quickly review utility bills and changes in conditions. Poor performance is generally obvious to the reviewer when comparing the various parameters. CxA/QA providers can typically help owners understand when operational tolerances are exceeded and can provide assistance in defining what actions may be required to return the building to peak performance.

ENVELOPE

Opaque Envelope Components

Good Design Practice

EN1 *Cool Roofs* (Climate Zones: ❶ ❷ ❸)

Cool roofs are recommended for roofs with insulation entirely above deck and for metal building roofs. In order to be considered a cool roof for climate zones 1–3, a solar reflectance index (SRI) of 78 or higher is recommended, as determined by ASTM E 1980. The solar reflectance and thermal emmittance property values should represent long-term performance, such as three-year aged values to account for aging and soiling of roofs. Ratings should be determined by a laboratory accredited by the Cool Roof Rating Council.

EN2 *Roofs, Insulation Entirely above Deck* (Climate Zones: all)

The insulation entirely above deck (see Figure 5-1) should be continuous insulation (c.i.) rigid boards because there are no framing members present that would introduce thermal bridges or short circuits to bypass the insulation.

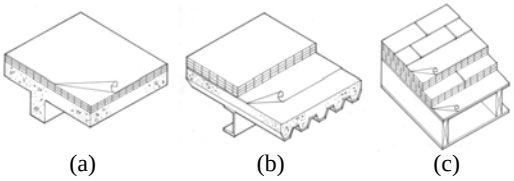

Figure 5-1. (EN2) Insulation entirely above deck—insulation is installed above (a) concrete, (b) metal, or (c) wood deck in a continuous manner.

When two layers of c.i. are used in this construction, the board edges should be staggered to reduce the potential for convection losses or thermal bridging. If an inverted or protected membrane roof system is used, at least one layer of insulation is placed above the membrane while a maximum of one layer is placed beneath the membrane.

EN3 *Roofs, Metal Buildings* (Climate Zones: all)

In metal roof building construction, purlins are typically z-shaped cold-formed steel members, although steel bar joists are sometimes used for longer spans.

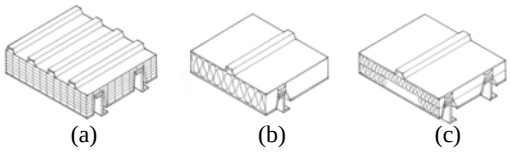

Figure 5-2. (EN3) Prefabricated metal roofs showing thermal blocking of purlins.

The thermal performance of metal building roofs with fiberglass blankets is improved by addressing the thermal bridging associated with compression at the purlins. The two types of metal building roofs are standing seam roofs and through-fastened roofs. Standing seam roofs have very few exposed fasteners and utilize a concealed clip for the structural attachment of the metal roof panel to the purlins. The larger gap between the purlin and the roof sheets, along with the thermal space block, provides a thermal break that results in improved performance compared to the standard through-fastened metal roofs. It is recommended that the thermal resistance between the purlin and the metal deck be at least R-8. One means to accomplish this is by using a 3/4 × 3 in. foam block (R-5) over 3/4 in. of compressed fiberglass blanket (R-3) (see Figure 5-2). Alternatively, a 2 in. space filled with compressed fiberglass insulation will provide roughly R-8.