

ROOFING QM INSPECTION GUIDE

A TERMINOLOGY:

- RCx:** Roofing Commissioning/Inspection
RCx Team: USF FM Roofing Commissioning/Inspection Team (BCA inspectors, USF PM's, USF QM)
BCA: Building Code Administrator (Construction Permitting Authority)
USF FM-DC: USF Facilities Management – Design & Construction

B SUBMITTALS REVIEW:

1. All submittals must be fully reviewed and approved by the [Architect of Record](#) and the [Prime Contractor](#) prior to submission to the [RCx Team](#).
2. The [RCx Team](#) will provide findings and recommendations in the post-submittal review meeting; and communicate [FM-DC Roofing inspection program](#) requirements in the [Pre-Roofing Conference](#).
3. The [RCx Team](#) will not preempt nor substitute the statutory, professional or contractual responsibility of the [Building Code Official](#), [Architect of Record](#), the [Prime Contractor](#) or the [Roofing Sub-Contractor](#).
4. Revisions to the drawings, specifications and submittals recommended by [RCx Team](#) must be approved by the [USF Project Manager](#); [RCx Team](#) does not have authority over project program, budget or schedule.
5. **BCA shall review and approve final submittals for all roofing projects for code compliance.**

C PROGRESS OF WORK:

1. The [RCx Team](#) will not hold-up or delay the construction progress and will make every effort to provide timely review comments.
2. The [RCx Team](#) will make every effort to provide [RCx QM \(Quality Management\)](#) inspections twice each day of roof installation.
3. Approved work based on approved submittals may proceed even without the [RCx Team](#) inspection, if request for inspection was made and acknowledged but [RCx Team](#) staff fails to inspect timely.

D CODE INSPECTIONS:

1. Code inspections are independent of the [RCx QM](#) inspections and must be coordinated with the [BCA](#) by the [Prime Contractor](#).
2. No work can begin without the required [BCA](#) review of code required submittals, inspections, approvals and **permits**.

E RESPONSIBLE SUPERVISION:

1. The [Prime Contractor](#) and the [Roofing Sub-Contractor](#) must provide responsible supervision on each day of roof installation
2. Such responsible supervision must be documented in the [FM-DC Roofing Inspection form](#) with the roof plan printed in the back page with the day's area of work clearly demarcated.
3. Photographic record of existing conditions, anomalies observed, exemplars of each phase of work during progress, completion of each phase of roof installation, and record of final completion shall be provided to the [USF Project Manager](#) at Owner acceptance of roofing project completion.
4. At the start and the end of each day's planned roof installation, the superintendents or the project managers of the [Prime Contractor](#) and the [Roofing Sub-Contractor](#) must inspect the area of work and sign the [FM-DC Roofing Inspection form](#) indicating acceptable conditions and preparations before and after each day's work.

F USF OF ROOFING INSEPCTION FORM:

- A. **WEATHER:** weather report at the start of work day and when work is stopped due to weather,
- B. **WORKERS:** number of workers present, also noting the presence of roofer superintendent/supervisor,
- C. **STARTING CONDITIONS:** narrative to explain the condition of the roof deck, substrate(s) and stored material at the start of the day; describe adequacy of protection provided from previous day.
- D. **DEMONSTRATE SKILL/KNOWLEDGE:** leading roofer describe/demonstrate work activity planned for the day
- E. **WORK HOURS:** start & stop time of work, including prolonged periods of inactivity (including lunch break)
- F. **WORK PLANNED FOR TODAY:** describe work planned for the day; highlight area of work on the scaled roof plan on back page.
- G. **CORRECTIVE ACTION:** any corrective action taken to remove water, debris and unsatisfactory work,
- H/I. **WEATHER PROVISIONS/END OF THE DAY:** provisions for securing/stocking materials against rain and condensation; and preparations made to secure the work area at the end of work day.
- J. **SIGNATURES:** required signatures before start of work and at the end of work day. The Owner [RCx Team](#) representative will observe provisions made in responses to items **G**, **H** and **I** above.

G ROOFING QM REFERENCE & CHECKLIST:

I BCA INSPECTIONS (FBC REQUIRED INSPECTIONS ARE PROVIDED BY THE BCA)

NOTE: following is a partial list of required inspections prior to roof sheet installation.

- 1 Energy code compliance for minimum R-value.
- 2 Attachments per manufacturers for wind uplift. Whether adhesive or mechanical fasteners. Fully adhered requires more time.
- 3 Clearance for Mechanical equipment per FBC Building 1509.7.
- 4 Installations per manufacturers approved submittals including flashing heights etc.
- 5 Mechanical fasteners required prior to cover. Etc.
- 6 Roof access for mechanical equipment 1509.6.
- 7 Railings per 1013.5 & 6.
- 8 Inspection of patterns and quality of the spot welds.
- 9 Inspection of the paint over the spot welds. Zinc – galvanized paint.
- 10 Clean rusty areas and touch up with galvanized paint.

II RCX INSPECTIONS (REFERENCE GUIDE FOR USF RCX TEAM)

A PROTECTION OF WORK IN PLACE

- 1 Provide measures to prevent water from entering into the **corrugation/voids** underneath installed insulation. Protect installed roofing materials against **condensation & rain**. Installing **temporary water dams** should be considered. Wipe down dry the roof substrate prior to installation of subsequent layers of roofing.
- 2 At the earliest time practical, open **roof drains** in the areas of new roof install.
- 3 If using a **gas** or **diesel generator** on the roof for temporary power, place a layer of **plywood** over rigid insulation board to protect installed roofing.
- 4 Remove and replace all roofing material contaminated by **fuel spill** (even if dry & no fuel odor is detected).
- 5 Provide **rigid roof insulation board** for use as **laydown area** for tools, and heavy or sharp objects. Provide **3/4" plywood** over rigid insulation board for temporary concentrated load. Provide rigid insulation board under skids and pallets of roofing material.
- 6 Ensure the **base sheet** is not left **exposed to weather** beyond manufacturers' recommended exposure time. Ensure **base sheet** is completely dry before commencing with **cap sheet** install. When the color of the **base sheet** has faded significantly under UV, or in doubt, require Manufacture Rep inspection and approval of the **base sheet condition** prior to proceeding with **cap sheet** install.

B PROTECTION OF INSTALLED WORK OVERNIGHT AND STORED ROOFING MATERIALS

- 1 **Schedule work** so that no installed insulation boards are left uncovered. Tarp alone, even if weighed down is not an acceptable protection of installed work. Correctly installed work is too valuable to take chances with insufficient protection.
- 2 When **segmenting** or **phasing large installation**, break work at architectural feature that best protects installed work and minimizes potential for water damage to installed work. Do not break or suspend work in the **valleys, low points** or where **curbs** are installed in **large sheet flow** areas.
- 3 Protection of **stored insulation board**. Fully pallet and tarp all stored material. Pending weather conditions, strap down stored material as required, or move to area of protected cover.
- 4 Protect the **exposed edge of insulation** as work progresses. Do not use wet insulation. Do not use previously wet and dried insulation.
- 5 The **base sheet** should overhang insulation boards & staggered so that work can continue next day without interruption. Adhere **minimum of 6"** of the **base sheet** overhang to the structural deck to resist wind uplift.
- 6 **Metal decks**: use expanding foam insulation to plug all metal deck flute/voids; and overhang **base sheet minimum of 3'** from the edge of installed insulation boards when securing work at end of work day.
- 7 **Concrete decks**: use expanding foam insulation to seal bottom edge of insulation boards against the concrete deck; apply roof cement/adhesive on all exposed edges of the insulation boards and overlap **base sheet minimum of 3'** beyond the edge of installed work when securing at end of work day, adhere **6"** of base/cap sheet directly to concrete deck, and weigh down the loose end of **base sheet**.
- 8 **Continuation of work** on following day: ensure all trace of water from condensation and rain is removed. All debris is swept. Peel back the staggered membrane as required to seamlessly continue with installation.
- 9 Ensure Prime Contractor complies with the **FM-DC Heavy Weather Provisions**. Prior to weather events, adequate provisions are made to protect the roof and installed work from high winds and rain.

C GOOD HOUSEKEEPING PRACTICES

- 1 Use broom or Shop Vac to **pick up all debris daily** or more frequently as necessary. Use leaf blower with caution. Do not accumulate waste/trash on roof; do not mix food waste with construction debris. Sharp metal objects, loose screws, welding rods, etc. must be picked-up by hand, immediately.
- 2 Prior to start of installation of each layer of roof system, conduct an inspection for debris.

D TEMPORARY FALL PROTECTION

- 1 Provide a system that **does not penetrate or damage the installed roofing** membrane whenever possible. Review with USF if alternative means are required.
- 2 Temporary safety railing should be supported at vertical surfaces whenever practicable to do so.

E METAL DECK

- 1 Avoid over-torching metal deck. Excessive holes from welding must be **patched** with an appropriately sized piece of metal decking. All patching of metal deck must be approved by **A/E of Record**.
- 2 Ensure all **voids at deck edge** and wall are filled with appropriate insulation - no open voids can remain that potentially short-circuit fire protection rating or roof thermal insulation value.

F LIGHTWEIGHT INSULATING CONCRETE

- 1 The lightweight insulating concrete must properly **cure and remain dry at all times**. Any wet sections will be tested for moisture content prior to any installation of work.

G TAPERED INSULATION

- 1 Identify **minimum & maximum thickness** of tapered insulation allowed by the manufacturer.
- 2 Confirm **minimum slope** on tapered insulation.
- 3 Minimize **dips & gaps** at the intersection of tapered insulation. Tapered insulation should **intersect at 45°**.
- 4 Minimize use of **very narrow strips** or **very small pieces of insulation**. Every piece of insulation must be adhered-- either mechanically fastened or fully adhered; this preclude use of small pieces.
- 5 Ensure **fastener plates & screws** are straight. Hold a level over the plate, if screw head protrudes, replace. Angled screw heads may telegraph onto the **cap sheet** leading to excessive wear & failure.

H SLOPE

- 1 Minimum slope **1/4" per foot**.
- 2 At **Cricket**s, provide minimum slope of **1/2" per foot**. Slope at maximum recommended by manufacturer and required by Code. Provided with cricket @ **roof curbs** equal to/greater than **1'** in width measured perpendicular to the water flow.

I CANTS

- 1 Provide **rigid cants** – do not use fiberglass or easily compressible material for cant.
- 2 Easily compressible or **fiber cants** are not acceptable.
- 3 Pressure treated **wood cants** are acceptable when wood blocking is required for structural support; **rigid bitumen cants** imbedded in roof cement that do not require wood blocking is preferred. If wood cants are used, ensure it is laid crown side up and the blocking aligns with insulation.
- 4 Minimum height of screws/fasteners on pressure bars, flashing and counter flashing shall be measured from base of the cant. No screws/fasteners shall penetrate the roof membrane below **10"** measured from the base of the cant.

J CAP SHEET (TOP SHEET) INSTALL

- 1 **Backside of parapets** up to **48"** above roof deck shall have **cap sheet** wrap over the parapet entirely.
- 2 Parapet coping **blocking**: all pressure treated wood blocking shall be laid **crown side up** and joints staggered if 2 or more layers are installed. The top layer of wood blocking shall be joined as **45°** mitered scarf cut with **1/8"-1/4"** gap for expansion & to prevent buckling.
- 3 All **cut lumber edge** shall be "**eased**" with **rasp or router** to prevent sharp fold/break in cap sheet. CIP and tilt up concrete panels with sharp edges shall be **eased with grinder**.
- 4 Relax membrane prior to install; allow membrane to stretch out, remove wrinkles and uncurl the ends rolled tight against the tube. Reject roof membrane that remains rippled in appearance **48 hours** after installation.
- 5 **Bleed out**: excess cold applied bitumen cement or liquefied bitumen when torch applied is squeezed out at membrane overlap; typically **1/8" to 1/4"** of bleed out indicate sufficient adhesion. **Less than 1/8"** of bleed out may indicate insufficient amount of adhesive coverage or inadequate heating by torch, and must be probed. **Excess of 1/4"** may indicate over application of cement, inattention during mopping or overheating by torch. Avoid "**buttering**" lap edges (applying roof cement over the lap) which disguises the insufficient/defective lap.

- 6 **Overlap:** typically **6-10"** (**minimum 6"**) at ends of roll and **2-3"** (**minimum 3"**) alongside edges. Trim rounded or chamfered the exposed corners of **cap sheet** to minimize curling and delaminating. An overlay patch should have all corners rounded or chamfered. Shingled in direction of water flow. Staggered overlaps between **base sheet** and **cap sheet** minimum **4'** whenever possible. Any bitumen to granule lap must have the granules embedded by means of heating the granules and floating them down into the bitumen ensuring not to scrape them off. Scraping off removes bitumen and exposes the reinforcement. This will give a true bitumen to bitumen bond. Asphalt primer is not an acceptable practice for this condition.

K PRESSURE BARS (TERMINATION BARS)

- 1 **Pressure bar** with integral cleats to snap counter flashing in place is preferred to minimize use of fasteners. The **surfaced mounted counter flashing** (installed over the pressure bar) top caulk trap should be cleaned and filled with even, rounded, raised bead of caulk – do not “tool” the bead. All **surface area** in contact with sealant or caulk must be cleaned thoroughly – all paint, dirt, foreign substances must be removed and bare surface must be provided prior to caulking.
- 2 **Hidden fasteners/washers** (not exposed to weather) in contact with metal flashing/anchor clip/pressure bar must be same/comparable material. Stainless steel screws and washers are preferred.
- 3 Verify required spacing on center of fasteners by manufacturer and verify that adequate **substrate** exists to fasten into with required spacing. Gypsum sheathing is insufficient to provide the holding strength required of the fasteners.
- 4 Ensure that **substrate is rigid and provide proper hold for fasteners**. Gypsum Sheathing boards do not provide adequate holding for fasteners; provide minimum **3/4"** **plywood** sheathing as substrate. Fully insulate cavity in the stud spaces behind the substrate at parapets, even if it does not fully enclose occupied spaces – ensure continuous weather envelope.
- 5 The screws/fasteners of the pressure bar should be minimum **10"** above the base of cant. At roof & parapet intersection, extend upturned base sheet membrane measured **10"** from base of cant.

L FASTENERS

- 1 Provide **spring clips & cleats** to hold down flashing whenever practical to do so (and @ exposed exterior elevations). Exposed fasteners/screws may be used when impractical to use spring clips & anchor cleats/clips.
- 2 When exposed to weather, rivets should be avoided. If using **metal rivets** to fasten flashing at straight overlap only, rivets must be same material as the flashing and provide dollop of sealant at each rivet head.
- 3 If screws are used exposed to weather: provide **stainless steel screws with neoprene washer**; provide dollop of sealant at each screw head and washer. Do not use rubber washers.
- 4 Whenever practical to do so, provide continuous pressure bars and spring clips/cleats; stagger splices with minimum of **12"** overlap; and avoid any segment less than **24"** in length.
- 5 Avoid exposed screws/fasteners whenever practicable to do so, continuous spring clip and cleats are preferred means of attachment counter flashing/coping cap for ease of repairs and reroofing.

M SEALANTS (CAULKING)

- 1 **Preparation:** clean substrate to raw surface. Paint should be removed, sealant will not develop full adhesion to paint, especially degraded, heavily oxidized paint.
- 2 Do not apply over old sealant: When sealant is haphazardly applied over irregular surface or over old sealant, the structural property is compromised and adhesion and material failure occurs.
- 3 For application in expansion joints: ensure uniform width of gap & uniform depth of sealant at **ratio of depth = 1/2 x width** (or calculated by A/E of Record). Depth control can be achieved with properly sized backer rod.
- 4 **Pressure bar** (with flashing of cap) with integral cleats to snap counter flashing in place is preferred to minimize use of fasteners. **Caulk trap** of surface mounted **counter flashing** should be cleaned and filled with even, rounded bead of sealant – do not “tool” the bead. All surface area in contact with sealant must be cleaned thoroughly – all paint, dirt, foreign substances must be removed and bare surface must be provided prior to application of sealant.

N FLASHING/COUNTER FLASHING

- 1 Identify datum **elevation** at top of: insulation; cants; parapets; ridges; valleys; curbs; window sills; door thresholds; overflow drain; counter-flashing. Ensure top of flashing and bottom of counter flashing terminates minimum **2"** above the elevation of the overflow drain
- 2 Maintain **level and continuous flashing & counter-flashing elevation** – established the datum at the highest point– do not follow the slope of the taper or roof surface; exception for single slope roof.
- 3 Maintain top of pressure bar or **termination edge** of roofing membrane minimum **4"** above top of the overflow scuppers or overflow drain lip.

- 4 Ensure bottom edge of coping cap/counter flashing extend **2"** below top elevation of continuous exterior wall finish.
- 5 The top **edge of base flashing** must be minimum **10"** above base of the cant strip and must be set above the overflow drain or scupper.
- 6 **Mockup of inside and outside corners, and other compound shapes** must be reviewed for proper shingling effect and adequate overlaps vertically and at lap joints. All mitered joints should be **fully welded or fully soldered**. Field modified joints and compound shapes should be avoided.
- 7 The bottom edge of the **counter flashing** shall overlap the row of screws/fasteners **minimum of 2"**
- 8 Whenever possible, **saw kerf & reglet** (or slip into cement grout in CMU wall) **counter flashing** into substrate; wedge into the reglet & seal with a bead of sealant in reglet. Provide stainless steel screws & neoprene washers and continuous bead of sealant when installing **Surface mounted counter flashing**.
- 9 **On single ply membrane roof:** Use **pre-molded flashing, inside and outside corners**. Use **prefabricated curb flashing**. Provide **minimum 60 mil membrane**, minimum **80 mil flashing**, and modular prefabricated non-slip **traffic pads** (30" x 30" pads with 3" separation between pads).

O COPING CAP

- 1 Provide metal **coping cap**, stainless steel is preferred. Powder coated aluminum flashing is approved.
- 2 On vertical leg of coping cap/counter flashing, provide **minimum 2" overlap** measured from bottom of "kick" to where transition or break occur in substrate material and/or where row of screws/fasteners for cleat/pressure bar is spotted.

P ROOF DRAINS

- 1 Open roof drains when tied in at the earliest time practicable to drain installed roof. Keep the roof drains clear of debris. Remove roof drain plugs (if used) immediately after the drains are fully operational.
- 2 Note the **standing water** at roof drains – look for staining and other indications. If standing water **beyond 72 hours** is observed, the affected area may require new tapered insulation and re-roofed.

Q DOORS OPENING ON TO ROOF

- 1 Provide section details of roof and **door threshold & window sills**. Confirm that the location of the threshold will not conflict with the height of the tapered insulation.
- 2 Ensure **door threshold & windows sills** are minimum **10"** above roof deck to fully develop a flashing/counter flashing detail. Ensure that the elevation of thresholds and sills are minimum **4"** above overflow drain lip or **4"** above top of scupper opening.

R TRAFFIC PADS

- 1 Provide slight color contrast between roofing membrane and traffic pads.
- 2 Provide **sacrificial pads** at all locations where objects may rest on the roof and where abrasive movement may occur. Traffic pads are required from minimum one roof access point to all roof top equipment service side that require periodic servicing & maintenance and all equipment that includes electrical motors.
- 3 **On single ply membrane roof:** provide modular prefabricated non-slip **traffic pads** (30" x 30" pads with 3" separation between pads). Provide a layer of 60 mil membrane as traffic pad full width at roof hatch and access door landings.

S LIGHTNING PROTECTION

- 1 Place and adhere an **adhesive base** (cable hold down clip) underneath every buckle, clamp, splice, cable ends, etc. for added protection against abrasion and puncture. Ensure all threaded ends of bolts are turned up to protect against puncture.
- 2 Provide **sacrificial pad** under each **adhesive base** (cable hold down clip / cable fasteners), turnbuckle, clamp, splice connector, ends of conductors, etc. resting on roof membrane. The sacrificial pad should be cut from the cap sheet and fully cemented in place. Minimum 4 times the size of the adhesive base.
- 3 Do not suspend conductors in clothes line style, ensure it is fully rested on horizontal surfaces or fully attached in vertical surfaces using sufficient number and location of adhesive base cable fasteners.

T TESTING

- 1 **BCx Team** representative shall witness all required testing of roof system, including but not limited to: pull tests, adhesion tests, water penetration tests, etc.
- 2 Unless required by code or manufacturer warranty, avoid **"flood test"** under hydrostatic conditions (**2"** of standing water over **24 hours**). The **"flowing-water test"** under non-hydrostatic conditions is acceptable for forensic/investigative leak detection generally and at roof drain sump.