

HOSPITAL STANDARDS

203.203 BUILDING COMPONENTS, BUILDING SHELL, ROOFING

This document contains requirements for roofing elements for a hospital building and is in alignment with the UniFormat II, Level 2 classification – B30. The document is subdivided into the following parts per the UniFormat II, Level 3 classifications.

| UNIFORMAT II classification | | | | | MoP Document Number |
|-----------------------------|-------|---------------------------|---------|--------------------------------|---------------------------|
| Level 1 Major Elements | | Level 2 Group Elements | | Level 3 Individual Elements | |
| B | Shell | B30 | Roofing | B3010 | Roof Coverings |
| | | | | B3020 | Roof Openings |

ELEMENT B3010, ROOF COVERINGS. Includes general design requirements for roof coverings, roof system selection, membrane types, insurance requirements and other roofing elements. Specific items of note include:

1. Design requirements
2. Parapet walls
3. Membranes
4. Insulation
5. Flashings
6. Insurance requirements
7. Performance requirements
8. Warranty
9. Contract Document requirements
10. Testing and inspections

ELEMENT B3010, ROOF COVERINGS

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PART 1 - GENERAL**1.01 OVERVIEW**

- A. This standard describes the acceptable types of low-slope roofing systems for hospital building projects at BJC.
- B. This standard includes only non-bituminous membrane type low-sloped roofing systems with a slope less than or equal to 2:12 and equal to or greater than 1:48.
- C. This standard includes requirements for installation of new roof systems and requirements for re-roofing existing hospital buildings.
- D. The term “roofing system” is used to define the entire system including membranes, roof decks, air/vapor retarders, and roof insulation.
- E. This standard does not consider steep-slope or vegetated roofing systems.

PART 2 - DESIGN CRITERIA**2.01 GENERAL REQUIREMENTS**

- A. The architect shall be responsible to select the roofing system most appropriate to the specific project conditions. Refer to the Roofing Guideline for definitions, explanations and comparisons of roofing systems and roof coverings.
- B. All primary components of a roofing system shall be of the same manufacturer. All other materials such as insulation, fasteners, wood, coatings etc. shall be compatible with one another and shall be acceptable for used with one another by the roofing material manufacture and/or all parties providing a warranty.
- C. All new roofs or roof replacements shall be designed in accordance with the requirements of BJC’s insurance provider, FM Global. This includes the selection of a complete, pre-approved roofing system through the FM Global RoofNav program.
- D. When project characteristics require connecting with existing roofing systems, the selection of the new roofing system will be dependent on the compatibility of the existing system.
- E. Roof slope may be achieved by either sloping of the structure and deck, by using tapered insulation, or a combination of the two methods. For medical office buildings, the most economical solution tends to be the sloped structure approach with minimal use of tapered insulation.

- F. Minimum roof slope shall be 1:48 (1/4" per 1'-0"), regardless of manufacturer's approval for slopes less than 1/4" per 1'-0".**
- G. Risk Assessment shall be developed for all new roofing and re-roofing projects. Coordinate with BJC Project Manager.
 - 1. Identify existing air intakes for mechanical units, prevailing wind directions, and entrances for all occupied buildings in the area. Provide Safety Data Sheets as required.
- H. For projects involving repair/replacement of components of a roofing system, coordinate extent of work with Facility Engineering, BJC Corporate Engineer and BJC Corporate Architect.**
 - 1. **When required, BJC will engage a roofing consultant to inspect and assess the existing roofing system to determine extent of work.**
 - 2. **Provide unit costs as necessary to identify components that may not be able to be quantified in the drawings such as flashing and counter flashing, copings, nailers, blocking, cover boards, deck repair, etc.**

2.02 DESIGN CONSIDERATIONS

- A. There are a variety of factors that should be considered when determining the selection of a roofing system. Refer to the Roofing Guideline in Chapter 1 of the Manual of Practice for a complete list.
- B. The following factors are of greatest importance when selecting a low-slope roofing system for ambulatory care buildings:
 - 1. **TRAFFIC RESISTANCE.** Rooftop mechanical equipment in hospital buildings are frequently checked, inspected and repaired and the roof materials must be able to take repeated foot traffic without failure. The surfaces leading to and around the equipment should provide a safe, non-slip surface for workers.
 - 2. **PUNCTURE RESISTANCE.** Rooftop mechanical equipment in hospital buildings are frequently checked, inspected and repaired and the roof materials must be able to resist puncture that would cause a breach in the system.
 - 3. **ABILITY TO FIX PROBLEMS.** When leaks occur, the ability to quickly find and repair the condition is extremely important. Single-ply membrane roofs can be a little more difficult to track down and find the problem as the leaks tend to migrate horizontally before they appear internally. Multiple-ply roofs are not dependent on the integrity of a single-ply and so there are inherent layers of material that must fail in order for a leak to present internally.
 - 4. **LIFE CYCLE COST.** While initial cost is always a consideration, the ongoing life cycle cost of the roof covering is a more important characteristic for hospital buildings. Roofs for these buildings must perform for longer periods of time and with little to no effect to the building operations. Therefore, the less the roofing system needs to be maintained and the ease with which to do so reduces the ongoing life cycle cost overall.

5. **WARRANTY.** The longer warranty terms relate directly to the system and to the materials and components of the roof. Generally, longer warranty terms suggest a better system.
6. **INSTALLATION IMPACT.** It is imperative to analyze the impact environmentally, especially as it relates to the odors and off-gassing of some products. Consideration must be given for fresh air intakes and other similar openings that could negatively affect a person’s health. This requires complete awareness of all materials (adhesives, sealants, roofing materials, etc.) and the method in which it is installed. Safety Data Sheets should be closely reviewed and shared with EHS.
7. **ABILITY TO FIND PROBLEMS.** Much like being able to fix problems, the ability to find problems when they occur is very important for hospital buildings. The longer it takes to find a roof leak, the greater the disruption to building occupants.

2.03 MEMBRANE TYPES

- A. There are 2 basic types of low slope roof coverings: Single-ply systems and multiple-ply systems.
 1. Single-ply systems include Polyvinyl Chloride (PVC), Thermoplastic Polyolefin (TPO) and Ethylene Propylene Diene Monomer (EPDM).
 2. Multiple-ply systems include Built-up Asphalt systems, Atactic Polypropylene (APP), and Styrene-Butadiene-Styrene (SBS).
- B. Based on the design considerations identified above, both single-ply membrane roof system and multiple-ply systems may be considered for hospital buildings, but that will depend on the individual components that make up the system.
- C. **For all hospital building roofing projects (installation of a new roof or re-roofing/repair to an existing roof), it is imperative the design professional provide the following services.**
 1. **Review and verify the design considerations identified above with Facility Engineering, BJC Corporate Engineer, and BJC Corporate Architect. Document all criteria that drive the selection of the roofing system.**
 2. **Review the materials, products, and location of the proposed roof with respect to access, ventilation systems, mechanical units, and other items that may affect environmental conditions during installation.**
 3. **Review with BJC HealthCare’s insurance provider, FM Global, throughout the design phases to develop an acceptable roofing solution.**
- D. The following tables identify the permitted, conditionally permitted and those roofing components not permitted for hospital buildings. Conditionally Permitted indicates the system requires approval for use by BJC Corporate Engineer and Corporate Architect. Not Permitted indicates the system is not acceptable for hospital buildings.

Table. Single Ply Membrane Roof Coverings – Non-Bituminous

| | | | | HOSPITAL BUILDING | AMBULATORY CARE | MEDICAL OFFICE | ADMINISTRATIVE OFFICE | | |
|---|----------------------|-------------|--------------------------------|--------------------------------|----------------------------|------------------------|-----------------------|----|----|
| | | | | | | | | | |
| | | | | membrane thickness | membrane attachment method | surface characteristic | | | |
| NON-BITUMINOUS TYPE (Single-Ply) | Thermoplastic | PVC | 45 mil | loose laid membrane | ballast | NP | NP | NP | NP |
| | | | | mechanically-attached membrane | | NP | NP | CP | CP |
| | | | | fully adhered membrane | | NP | NP | CP | CP |
| | | | 60 mil | loose laid membrane | ballast | NP | NP | NP | NP |
| | | | | mechanically attached membrane | | CP | CP | CP | CP |
| | | | | fully adhered membrane | | CP | CP | P | P |
| | | 80 mil | loose laid membrane | ballast | NP | NP | NP | NP | |
| | | | mechanically attached membrane | | CP | CP | CP | CP | |
| | | | fully adhered membrane | | P | P | P | P | |
| | | TPO | 45 mil | loose laid membrane | ballast | NP | NP | NP | NP |
| | | | | mechanically attached membrane | | NP | NP | CP | CP |
| | | | | fully adhered membrane | | NP | NP | CP | CP |
| | 60 mil | | loose laid membrane | ballast | CP | CP | NP | NP | |
| | | | mechanically attached membrane | | CP | CP | CP | CP | |
| | | | fully adhered membrane | | P | P | P | P | |
| | Elastomeric | EPDM | 45 mil | loose laid membrane | ballast | NP | NP | CP | CP |
| | | | | mechanically attached membrane | | NP | NP | CP | CP |
| | | | | fully adhered membrane | | NP | NP | CP | CP |
| | | 60 mil | loose laid membrane | ballast | CP | CP | CP | CP | |
| | | | mechanically attached membrane | | CP | CP | P | P | |
| | | | fully adhered membrane | | P | P | P | P | |

KEY
 NP - NOT PERMITTED
 CP - CONDITIONALLY PERMITTED UPON APPROVAL
 P - PERMITTED

Table. Multiple Ply Membrane Roof Coverings – Bituminous

| | | | | | HOSPITAL BUILDING | AMBULATORY CARE | MEDICAL OFFICE | ADMINISTRATIVE OFFICE | | | | | | | |
|---------------------------------------|--|--|--|--|---------------------------------|----------------------------|------------------------|-----------------------|---|--|-------------------------|----|----|----|----|
| | | | | | | | | | | | | | | | |
| | | | | | membrane thickness | membrane attachment method | surface characteristic | | | | | | | | |
| BITUMINOUS TYPE (Multiple-Ply) | | | | | BUR | | Asphalt | | 3 ply | hot, mop applied | flood coat with ballast | NP | NP | NP | NP |
| | | | | | | | | | | | coating | NP | NP | NP | NP |
| | | | | | | | | | | | cap sheet membrane | NP | NP | NP | NP |
| | | | | | | | | | 4 ply | hot, mop applied | flood coat with ballast | CP | CP | NP | NP |
| | | | | | | | | | | | coating | CP | CP | NP | NP |
| | | | | | | | | | | | cap sheet membrane | CP | CP | NP | NP |
| | | | | | | | | | 5 ply | hot, mop applied | flood coat with ballast | CP | CP | NP | NP |
| | | | | | | | | | | | coating | CP | CP | NP | NP |
| | | | | | | | | | | | cap sheet membrane | CP | CP | NP | NP |
| | | | | | Polymer-Modified Bitumen | | APP | | Single Ply (base sheet plus cap sheet) | hot, mop applied base sheet and heat welded, torch applied cap sheet | cap sheet membrane | NP | NP | NP | NP |
| | | | | | | | | | | cold, adhesive applied | cap sheet membrane | NP | NP | NP | NP |
| | | | | | | | | | Double Ply (base sheet plus one intermediate ply sheet plus cap sheet) | hot, mop applied base/intermediate sheets and heat welded, torch applied cap sheet | cap sheet membrane | P | CP | NP | NP |
| | | | | | | | | | | cold, adhesive applied | cap sheet membrane | CP | CP | NP | NP |
| | | | | | | | | | Triple Ply (base sheet plus two intermediate ply sheet plus cap sheet - BUR hybrid) | hot, mop applied base/intermediate sheets and heat welded, torch applied cap sheet | cap sheet membrane | P | CP | NP | NP |
| | | | | | | | | | | cold, adhesive applied | cap sheet membrane | CP | CP | NP | NP |
| | | | | | | | SBS | | Single Ply (base sheet plus cap sheet) | hot, mop applied base sheet and heat welded, torch applied cap sheet | cap sheet membrane | NP | NP | NP | NP |
| | | | | | | | | | | cold, adhesive applied | cap sheet membrane | NP | NP | NP | NP |
| | | | | | | | | | Double Ply (base sheet plus one intermediate ply sheet plus cap sheet) | hot, mop applied base/intermediate sheets and heat welded, torch applied cap sheet | cap sheet membrane | CP | CP | NP | NP |
| | | | | | | | | | | cold, adhesive applied | cap sheet membrane | CP | CP | NP | NP |
| | | | | | | | | | Triple Ply (base sheet plus two intermediate ply sheet plus cap sheet - BUR hybrid) | hot, mop applied base/intermediate sheets and heat welded, torch applied cap sheet | cap sheet membrane | P | CP | NP | NP |
| | | | | | | | | | | cold, adhesive applied | cap sheet membrane | CP | CP | NP | NP |

2.04 INSULATION

- A. Board insulation. Polyisocyanurate is permitted. Coordinate with performance requirements, code requirements, project conditions and roof manufacturer requirements.
 - 1. CFC and HCFC-free cellular thermal insulation
 - 2. Closed-cell type with non-organic laminated felts per manufacturer's requirements, ASTM C 1289 Type 1.
 - 3. Roof U Values and air leakage shall meet or exceed the values noted in ANSI/ASHRAE/IESNA 90.1, 2007 Edition, minimum, and in accordance with all governing codes and regulations.

2.05 MISCELLANEOUS ROOF MATERIALS

- A. Roof decks for hospital buildings are typically cast-in-place concrete slabs. As such, equipment curbs (including but not limited to those for major ventilation fan units or HVAC units) shall be reinforced concrete.
- B. Cants, equipment curbs and supports, nailers, and other blocking shall be treated wood, no. 2 grade or better, straight and without splits or cracks, and shall be pressure treated. The maximum moisture content of the wood when installed shall be 19 percent or less. Plywood used in roof construction shall be marine grade.
- C. Nailers are required at all insulation terminations such as a roof edge, an expansion joint, and at any change in vertical profile of roof such as at a parapet wall. Pre-formed metal curbs and insulated curbs are not permitted.
- D. Fasteners shall be galvanized (G90, or better) or stainless steel, as recommended by the manufacturer of the wood treatment process in use.
- E. For large changes in vertical profile, an approved plywood faced "wall" with all voids filled with unfaced fiberglass batt insulation may be used.
- F. Flashings, curbs, expansion joints, and roofing terminations shall be at least 8" above the adjacent roof surface.
- G. Termination bars for single-ply membranes shall be provided where roof membranes terminate on a vertical surface.
- H. Roof to roof expansion joints shall be pre-manufactured bellows with a drainable internal system. Bellows shall be installed on curbs a minimum of 8" above the adjacent roof surface.
- I. Roof to wall expansion joints shall be pre-manufactured bellows with a drainable internal system. Bellows shall be installed on curb a minimum of 8" above the adjacent roof surface. Flashing and counterflashing shall be installed as required to maintain watertight conditions.

2.06 INSURANCE REQUIREMENTS

- A. FM Global is the property insurance provider for BJC and adherence to their requirements is required.**
- B. RoofNav is FM Global's database of pre-approved roofing systems and is available online. Selection of a particular roofing system from FM Global RoofNav is required.**
- C. Architect shall clearly indicate the proposed FM Global RoofNav number in the design and construction documents. The RoofNav number identifies specific manufacturers and products for that system. As such, in order to avoid proprietary conditions, the RoofNav number and associated specifications shall be identified as a basis-of-design.**
- D. Drawings and specifications are required for all roofing projects (new roofs and replacements/repairs) and shall be submitted to BJC and FM Global for review prior to bidding. Allow sufficient time for review.

2.07 PERFORMANCE REQUIREMENTS

- A. Fire Resistance Classifications.
 - 1. Internal fire resistance indicates the level of fire resistance a roofing assembly has when exposed to fire on its underside, from within the structure. Classifications are as follows.
 - a. Non-Combustible. Permitted. Deck will not burn or contribute fuel to a fire originating in the building. Deck prevents heat from passing through the deck to the combustibles above the deck for a minimum of 30 minutes. Typically these are cast-in-place concrete roof decks which are common for hospital buildings.
 - b. Class 1. Conditionally Permitted. Roof will not propagate an interior building fire. The combination of materials in the assembly limits the amount of fuel contributed to an interior fire to within acceptable limits. Typically these are metal deck with insulating materials which are not as common roof decks for hospital buildings.
 - c. Class 2. Not Permitted.
 - 2. External fire resistance ratings indicate the level of fire resistance a roofing assembly has when exposed to fire on its top or sides, external to the structure. FM Approved assemblies are rated Class A, Class B, or Class C and correspond with ASTM E108 (17) fire ratings.
 - a. Class A. Permitted. Required for most building types and with any of the following conditions. The exterior fire exposure to the roof is severe, the occupancy is particularly susceptible to smoke and/or water damage, or the building is subdivided by a firewall.
 - b. Class B. Not Permitted.
 - c. Class C. Not Permitted.

Table. Fire Resistance ratings

| KEY | | | HOSPITAL BUILDING | AMBULATORY CARE | MEDICAL OFFICE | ADMINISTRATIVE OFFICE |
|----------------------|---------------------------------------|-----------------|-------------------|-----------------|----------------|-----------------------|
| NP | NOT PERMITTED | | | | | |
| CP | CONDITIONALLY PERMITTED UPON APPROVAL | | | | | |
| P | PERMITTED | | | | | |
| performance category | classification | | | | | |
| Fire Resistance | Internal fire resistance | Non-combustible | P | CP | CP | CP |
| | | Class 1 | CP | P | P | P |
| | | Class 2 | NP | NP | NP | NP |
| | External fire resistance | Class A | P | P | P | P |
| | | Class B | NP | NP | CP | CP |
| | | Class C | NP | NP | NP | NP |

B. Hail. (Refer to the *RoofNav* website, *Hail Damage Map*.) All BJC HealthCare facilities are within the following Hail Damage Zone.

1. Severe Hail (SH)

C. Wind Uplift. Each FM Approved roof construction is rated for how much wind uplift pressure a roof assembly can withstand. These ratings are measured in pounds per square foot. Refer to the *RoofNav* website for help with calculating the ratings and actual pressures for the roof field, the perimeter and the corners. The program accounts for factors such as terrain, wind speed, wind-borne debris risk, and roof area dimensions.

1. Minimum rating of complete roof system shall be in accordance with UL 580: I-90.

2. Minimum rating of loose-laid and ballasted system (not preferred) shall be in accordance with FM P9513.

PART 3 - SPECIAL CONTRACT DOCUMENT REQUIREMENTS

3.01 GENERAL

A. Warranty.

1. Manufacturer shall provide a minimum twenty (20) year No Dollar Limit labor and materials warranty, and the roofing contractor shall provide a minimum two (2) year installation warranty. The roofing contractor shall have a minimum five (5) years of verifiable installation record with the manufacturer as a certified installer. Owner reserves the right to review and approve the installer's

qualifications. The installer's performance on previous projects may be considered before approval is granted to use the proposed installer.

3.02 FIELD QUALITY CONTROL

- A. Flood testing. At Owner's discretion and/or as required by manufacturer, a flood test in accordance with ASTM D 5957 may be performed on each roof area to check for leaks and ponding.
1. Initial test will be performed by Owner's testing company, unless required by manufacturer.
 2. Contractor will be responsible to repair leaks and repeat flood test at their cost until test pass and roof is watertight.
 3. Structural design shall take into account an average depth of 2.5" of water with a minimum depth of 1". Verify with Architect and Owner's testing company.
 4. Optional testing. Owner may perform electronic field vector mapping (EFVM) in lieu of flood testing as identified above.

PART 4 - PRODUCTS

4.01 GENERAL

- A. Not applicable.

End of B3010 – Roof Coverings

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RESPONSIBILITY MATRIX

The following matrix identifies those individuals, roles or departments responsible for maintaining the accuracy of the information and those responsible for providing input. Refer to Preface for detailed explanation.

| | BJC HealthCare | | | | | | | | | | | | | Hospital/Entity | | | | |
|----------------------|-------------------------------------|-------------------------------------|--------------------------|-------------------------------------|-------------------------------------|--------------------------|---------------------------------|--------------------------|--------------------------|--------------------------|---------------------------|----------------------------------|--------------------------|----------------------------|--------------------------|--------------------------|--------------------------|--------------------------|
| | PD&C | | | | | | Clinical Asset Management (CAM) | Risk Management | Real Estate | Ergonomics | Infection Prevention (IP) | Info Systems, Data, Telecom (IS) | Other: | Standards Review Committee | Facilities Engineering | Housekeeping | Security | Other: |
| | Corporate Architect | Corporate Engineer | Director of Planning | Director of Design | Director of Construction | Other: | | | | | | | | | | | | |
| Primary Authorship | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |
| Secondary Authorship | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> |

DOCUMENT REVISION HISTORY

The following table indicates the date the document originated and any subsequent revisions.

| 203.203 – Building Shell, Roofing | | |
|-----------------------------------|--|-------------|
| Issue | Description of Issue | Prepared by |
| 2012 v1 | Original Issue | G. Zipfel |
| 2012 v2 | Miscellaneous Review/Clarifications | G. Zipfel |
| 2016 v1 | reissued | G. Zipfel |
| 2018 v1 | Renamed as 203.203, misc. updates, table added | G. Zipfel |
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