

# DESIGN AND CONSTRUCTION GUIDELINES AND STANDARDS

DIVISION 7 • THERMAL & MOISTURE PROTECTION

## 07 50 00 • MEMBRANE ROOFING

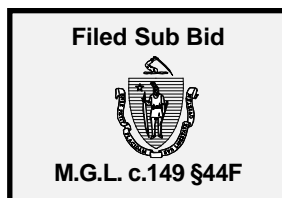
### SECTION INCLUDES

Built-up Roofing  
Modified Bitumen Roofing  
Rolled Roofing  
PVC Roofing  
EPDM Rubber Roofing  
TPO Roofing  
Access Walkways  
Roof Coatings

### RELATED SECTIONS

06 10 00 Rough Carpentry  
07 10 00 Waterproofing and Damproofing  
07 20 00 Building Insulation and Moisture Protection  
07 30 00 Asphalt Roof Shingles  
07 45 00 Gutters and Downspouts  
07 62 00 Sheet Metal Trim and Flashing  
07 90 00 Sealants

For Contracts estimated over \$100,000 that are predominately Roofing Work the DCAM category for the General Contractor should be **Roofing**. An alternative is to have the DCAM category as General Building Construction but will require filed sub-bids for the roofing. This requirement needs to be clearly spelled out in the Advertisement.



*When replacing membrane roofing is part of a larger General Contract, Roofing and Flashing is a stipulated filed sub-bid category under M.G.L. Chapter 149, §44F. While different types of roofing are typically specified in different specification sections, if the project's total cost is over \$100,000 and the cumulative estimated value of all roofing work exceeds \$20,000, it triggers the filed sub-bid requirement. It is then better to specify all roofing work in a single section to avoid confusion.*

### INVESTIGATION AND RESEARCH

The choice of roofing type and materials varies depending on many factors for every roof contract:

- Existing Conditions/Materials/Details(Reroofing contracts);
- LHA's capacity for maintaining a specific product;
- Location & height of building and the difficulty of getting materials to the roof;
- Wind Exposure - developments near the ocean or in other high wind areas require special design considerations and precautions during construction;

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- ❑ Design roof assemblies per the wind load requirements found in the building code, with adjustments for higher wind zones based on the building site and massing. Interview the LHA staff to better understand the specific conditions at the site;
- ❑ Type of Occupancy - some tenants have problems with strong odors;
- ❑ Walkway pads– review mechanical equipment and whether residents have access to roof. Address the issue of roof traffic in conjunction with selecting material. Single-ply roofing products require more protection if foot traffic is anticipated;
- ❑ Environmental considerations- discuss with LHA maintenance staff any unique circumstances, such as seagulls or other wildlife which may potentially damage roof and design protective measures where appropriate; and
- ❑ Future solar panel installations- review roofs for future solar potential and consider providing reinforcing, blocking or other improvements to facilitate future panel installation without adversely affecting new roof assembly.

Employ cost effective strategies-determine if the roof should be repaired or replaced. Although single-ply roofs require more maintenance over their lifetime, their lifetime can be extended by 50% or more using repairs

Inspect existing drains and specify cleaning drain lines, replacing flanges, and similar repairs as part of roof replacement contracts. Roof drain work, below the roof deck, is plumbing work and should be coordinated with the plumbing section of the specifications. Replacement of roof drain covers and inserts into existing drain lines is usually done by the roofing contractor.

### DESIGN

Combine roof penetrations through the roof membrane as much as possible and avoid using pitch pockets. Where pitch pockets are used, confirm that all manufacturers specified will warranty roof with pitch pockets. Liquid applied waterproofing, such as used with PVC roofs is not as durable as pitch pockets and details should be designed for redundancy if these details are employed.

Evaluate rooftop mechanical equipment and assess whether replacement is a cost effective option. Flashing details are more difficult to achieve when cutting an existing roof than when installed as part of a new roof assembly.

Do not mount equipment on top of roof insulation; use pre-fab equipment manufacturer's curbs or steel equipment racks or design wood blocking to be tied directly to the structural roof deck. Integrate the flashing into the roof assembly.

### TECHNICAL STANDARDS

National Roofing Contractors Association [www.nrca.net](http://www.nrca.net)  
Roof coating Manufacturers Association [www.roofcoatings.org](http://www.roofcoatings.org)

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DIVISION 7 • THERMAL & MOISTURE PROTECTION

## 07 50 00 • MEMBRANE ROOFING

### BUILT UP ROOFING

#### MATERIALS

Refer to the manufacturer for all components and specify work so that all products are provided by one source to prevent suppliers from backing out of their warranty.

Type III asphalt should be used at a minimum and Type IV asphalt shall be used if slope is greater than ¼" per foot. Cold process B.U.R. or modified bitumen is acceptable and preferred on sites where odor is a concern. Minimum of type VI felts and a 4-ply system should be used. Aggregate should meet the requirements of ASTM D 1863, 3/8" or 9 mm nominal. SBS modified FR cap sheet with granules is also acceptable as surfacing. No expanded polystyrene insulation (EPS) will be allowed in any built up roofing system system. Roof insulation thickness shall meet the energy requirements of the current building code, including any Stretch Code provisions



All materials and details should meet the requirements of NRCA, SMACNA, UL and FM, as applicable.

#### DESIGN

Built-up roofs must have a minimum of 3 plies and minimum pitch of 1/4 inch per foot to drain. Built-up and modified bitumen roofing are available with manufacturer's 25 year warranty which is longer than most membrane roofing warranties. Specify the warranty period required for the project. Built-up roofing is preferred in family development where tenants may have access to the roof or where there is a significant amount of rooftop equipment which will require servicing.

Minimum flashing height requirements are 8" for all mechanical, skylights, wall flashings or any other item that extends above the roof line. This is a minimum flashing height; windows or other such items should be well above 8" above the roof line.

All mechanical equipment is required to be set on curbs which are placed on roof deck or on vibration insulators. No equipment should sit on insulation.

All aluminum (coping, counter flashings and edge metal) associated with roof system should be a minimum of 24 gauge (.032 inch) and color clad. Copper, zinc and zinc-coated copper can be used in certain applications.

#### EXECUTION

Do not install hot applied built-up roofs during winter months and avoid overheating hot asphalt during application which affects material performance.

Install cold applied built-up roofing according to manufacturer's installation requirements for warranty specified.

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DIVISION 7 • THERMAL & MOISTURE PROTECTION

## 07 50 00 • MEMBRANE ROOFING

Contractor shall furnish roofing manufacturers shop submittals for Architect review and approval. In addition, any changes to those details should be reviewed by both the Architect and the roofing manufacturer's field representative.

Do not close out the project until the roofing manufacturer has inspected the roof and confirmed acceptance for issuance of warranty.

### MODIFIED BITUMEN ROOFING

#### MATERIALS

Modified bitumen products are acceptable in appropriate circumstances over traditional built-up roofing. Modified bitumen roofing comes in either APP (Atactic Polypropylene, hot applied only) or SBS (Styrene Butadiene Styrene, hot or cold applied) membrane rolls.

Cold applied roofing or SBS is a cost effective alternative to using hot asphalt for built-up roofing or torch applied modified bitumen roofing systems. The cold applied can be solvent-based or water based. Acceptable manufacturers of cold applied modified bitumen roofing include Soprema, Johns Manville, GAF, the Garland Company, and Tremco

#### DESIGN

Determine if hot applied, torch applied or cold applied modified bitumen is appropriate for the project due to the location of the roof, access, occupancy etc. Modified bitumen roofing can have a 10, 15 and 20 year warranty which should be clearly specified in the specifications.

Cold applied roofing eliminates the odors associated with hot asphalt built-up roofing. In areas that have difficult access for hot asphalt equipment such as high-rise buildings it is also a plus. Cold applied roofing can be applied during colder weather, however specialized equipment to maintain materials above 40 degrees is often required. The likelihood of achieving the best workmanship, durability and longevity is increased if roofing is applied in temperatures over 40 degrees.

Do not install roofing, except temporary roofing in emergency situations, when daily temperatures are below freezing.

Cold applied modified bitumen roofing can also be used in "green roof" installations under soil and plant materials to provide a waterproof membrane. Garland's GreenShield System is an Energy Star approved commercial roofing system.

Alternately, EPDM and PVC roofs may be used.

### GREEN ROOFS



Green roof assemblies typically require several additional components of roofing materials, including root protection mats, water retention mats, soil and plants. The existing roof structure should be reviewed by a licensed structural engineer prior to the conversion of a traditional low-slope roof to a green roof to confirm the structure's ability to withstand additional loads.

It should also be noted that these roofs require significant additional maintenance; therefore their use is not generally recommended. Although well designed and maintained planted roofs can extend the life of the roof

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DIVISION 7 • THERMAL & MOISTURE PROTECTION

## 07 50 00 • MEMBRANE ROOFING

membrane below, their additional life cycle costs do not justify their use for most DHCD projects. There are many other more cost effective alternatives to provide 40-50 year roof lifespans.

### EXECUTION

APP modified bitumen roofing is applied using a torch.

SBS modified bitumen roofing can be installed by heat welding, hot asphalt, cold applied adhesive, mechanical attachment or as part of a self-adhered system.

Before work proceeds, a pre-installation meeting must be held with representatives from the manufacturer, architect, roofing contractor, general contractor, LHA, and DHCD.

Install modified bitumen roofing according to manufacturer's installation requirements for warranty specified.

Note that approved details for items such as roof drains, flashing and penetrations vary among manufacturers. Prefabricated metal flashings are preferred over field liquid-applied flashings and manufacturer approvals should be obtained when using non-conventional more durable flashing details. Pitch pockets are preferred over liquid-applied details for items such as conduit penetrations and roof-mounted guard railing assemblies.

### PVC SINGLE PLY ROOFING

### MATERIALS

Reinforced PVC is acceptable as a single-membrane roofing system and is much preferred over EPDM. Acceptable manufacturers include Sarnafil, GAF, Carlisle, Fibertite and Johns Manville.

Unacceptable: Stevens Hypalon and unreinforced PVC products by Trolcal.

Use PVC membrane in minimum 60 mils thickness, complying with ASTM 4434, Type 1. Thicker PVC membrane is available and can be used in certain circumstances.

### DESIGN



Unlike black EPDM rubber roofing, PVC roofing comes in white or light colors and can reduce energy consumption, abate urban heat and help to slow the reaction of smog forming pollutants. The light color provides a high level of solar reflectance for urban settings and reduces the amount of energy required to maintain comfort in an air-conditioned building by reducing heat flow through the building envelope. Sarnafil's EnergySmart Roof has an Energy Star listing in certain applications.

PVC roofing can also be used in "green roof" applications under soil and plant materials to provide a waterproof membrane. Sarnafil offers a range of waterproofing systems specifically for Green Roofs.

Specify products with welded seams and minimum 15 year warranty.

# DESIGN AND CONSTRUCTION GUIDELINES AND STANDARDS

DIVISION 7 • THERMAL & MOISTURE PROTECTION

## 07 50 00 • MEMBRANE ROOFING

Combine roof penetrations through the roof membrane as much as possible.

### EXECUTION

Before work proceeds, a pre-installation meeting must be held with representatives from the manufacturer, architect, roofing contractor, general contractor, LHA, and DHCD.

Install PVC roofing according to manufacturer's installation requirements for warranty specified.

### TPO ROOFING

### MATERIALS

TPO (thermoplastic polyolefin) roofing is a new product to DHCD and the designer must demonstrate to DHCD why it should be used over PVC roofing. Acceptable manufacturers include Carlisle, GAF, EP Roofing Membrane by Stevens and Glenflex Heat-Welded Reinforced TPO Membrane. TPO are produced in white and light colors offering rooftop reflectivity to reduce air conditioning loads.

### DESIGN

Specify white or light colored products with one or two side welded seams and minimum 15 year warranty. TPO membranes carry an Energy Star listings in certain applications with reflectivity ratings in the high 80 percent range where Energy Star specifications require 65 percent minimum. A benefit of using TPO roofing is that it is available in sheets up to 12 feet wide. Note that in New England's temperate climate reflective roofs are of limited value and the increased cleaning maintenance they require to maintain their initial reflectivity minimizes their cost-effectiveness. Also, they can be more slippery when wet, increasing the liability when no roof edge protection is present. Typically a bituminous membrane roof with a light colored granular surface provides a more-durable cost effective choice, even though it's reflectivity is not as high as some PVC and TPO membranes.



### EXECUTION

Before work proceeds, a pre-installation meeting must be held with representatives from the manufacturer, architect, roofing contractor, general contractor, LHA, and DHCD.

Install TPO roofing according to manufacturer's installation requirements for warranty specified.

### EPDM RUBBER ROOFING

### MATERIALS

Specify complete EPDM (Ethylene Propylene Diene Monomer) rubber roofing systems (including all roof components) to ensure that the installation does not void the manufacturer's warranty.

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DIVISION 7 • THERMAL & MOISTURE PROTECTION

## 07 50 00 • MEMBRANE ROOFING

Consider the comprehensiveness of the manufacturer's warranty when selecting a roofing system. Warranties vary with the manufacturer and installer. The minimum standard warranty should be 15 years.

Use EPDM in either 45 or 60 mils thickness complying with ASTM D 4637, Type 1. 90 mils thickness is also available by EPDM roofing manufacturers.

Use uncured neoprene flashing at penetrations for membrane roofs.

### DESIGN

Flat roofs with single-ply membranes must have a minimum pitch of 1/8 inch per foot for positive drainage. Single-ply membranes should not be installed on roofs with a pitch of over 2 in 12. Use parapets if possible and run roofing up wall in lieu of gravel stops.

EPDM roofing can be installed fully-adhered, mechanically-fastened or loose laid. Fully-adhered EPDM using water or solvent based adhesives to adhere the rubber to the substrate is preferred. Mechanically-fastened EPDM roofing should be avoided. A ballast of light colored round river rock or concrete pavers is used to hold the materials in place and in roof locations susceptible to high winds. For re-roofing projects ballast can be washed and reused.

Specify products with welded seams.

### EXECUTION

Install sheets as large as possible to minimize the number of seams.

Specify that the Contractor should provide a seaming diagram before installation. The seams are sealed using either an adhesive or a splice tape.

Before work proceeds, a pre-installation meeting must be held with representatives from the manufacturer, architect, roofing contractor, general contractor, LHA, and DHCD.

Do not rely solely on field inspections by the manufacturer's representative to ensure the quality of the installation. Use a clerk when possible or provide the architect more field supervision time in the contract.

Install EPDM rubber roofing according to manufacturer's installation requirements for warranty specified.

## ROLLED ROOFING

### MATERIALS

Rolled roofing comes in rolls composed of roofing felt saturated and coated on both sides with asphalt which contains fine mineral stabilizer. Asphalt rolled roofing is available smooth-surfaced or mineral surfaced. Smooth surfaced roll roofing is not as durable as mineral-surfaced roll roofing and is not recommended. Mineral-surfaced rolled roofing is available in 36 feet long rolls with the entire surface covered with granules, with a 2- or 4-inch bare lapping edge and with a 19-inch bare lapping edge.

# DESIGN AND CONSTRUCTION GUIDELINES AND STANDARDS

DIVISION 7 • THERMAL & MOISTURE PROTECTION

## 07 50 00 • MEMBRANE ROOFING

### DESIGN

Use rolled roofing on low slope roofs with a pitch of 1 inch to 6 inches per foot.

### EXECUTION

Coated roll roofing should only be applied in warm weather when the material is flexible. Avoid exposed nails wherever possible. A blind nailed 4 inch lap cemented with plastic asphalt gum is preferred to a 2 inch lap with exposed nails.

## ACCESS WALKWAYS

### MATERIALS

Ensure that access walkways are compatible with the specified roofing system. The benefit of a ballasted roof is that pavers are not required.

Pre-cast solid pavers are an acceptable material. Avoid organic materials such as wood or felt. Use walkway protection boards that are compatible with the roofing membrane that is being used on the project.

### DESIGN

Walkway protection requirement may be needed where tenants have emergency egress on roof between stair penthouses. Railings should also be designed and installed to direct traffic over roof and pavers or stone ballast installed.

## ROOF COATINGS

### MATERIALS

The application of white acrylic liquid roof coatings on existing membrane roofs helps to prolong the life to the roof and reflects the sun's UV rays and infrared radiation. Manufacturers include Snow Seal by Ames, CLP and Liquid Roof by US Coatings Solutions.

### EXECUTION

Apply roof coatings according to manufacturer's installation requirements for warranty specified.