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## *Coal Tar Application and Design Considerations*

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The proper specification of any roof system is extremely important to its long term performance. To assist designers and applicators in obtaining the desired results, Durapax offers the following information. Although major topics of consideration are discussed, many other elements (e.g. structural framing, climate, interior conditions, etc.) are important and must be taken into consideration. It is the responsibility of the design professional to take the information presented and determine that all segments of the overall project design are suitable. This material is offered in good faith as a guide to assist design professionals in obtaining the best roofing system possible. Since this information is presented only as a general guide, any actual roof system design must remain the responsibility of the specifier (architect, engineer, contractor or building owner).

As an additional reference guide, Durapax recommends the National Roofing Contractors Association Roofing and Waterproofing Manual. The information contained in this NRCA publication has been developed by industry experts from scientific evaluation and actual field experience. If presented with a situation not covered therein, consult your Durapax representative for clarification.

### SLOPE

Due to the unique cold flow, self-healing qualities of coal tar, installation on slopes higher than 1/2" per foot for tarred felt applications and 1/4" per foot for glass fiber felt applications, are not recommended.

Where these slope limitations are exceeded, provisions for adequate backnailing will be necessary.

Other slope restrictions exist. Refer to the applicable specification for specific information.

### VAPOR RETARDERS

The need for a vapor retarder must be determined by the system designer and must be based on climate, building construction, use and occupancy. The type of vapor retarder used must be

compatible with other roof system components, and be installed to provide a moisture-tight system. Although not covered by the warranty the vapor retarder can be an integral part of a successful roofing installation.

### INSULATIONS

The following guidelines apply:

Insulation must be specifically recommended by its manufacturer for each particular roof deck/membrane application.

Double layer applications are preferred wherever possible. When the first layer of insulation is mechanically fastened, an overlay board set in asphalt is required for 15 and 20 year warranties. Insulation joints should be staggered from the preceding layer the maximum distance possible. When only one layer of insulation is used and mechanically fastened, an organic base sheet mopped in asphalt is required, as the first ply of the membrane assembly.

Check specific deck requirements since certain roof decks require insulation to be installed prior to the membrane application (i.e. structural wood fiber).

No more insulation should be installed than can be covered by the complete membrane system in the same day. Phase construction is not allowed.

All board insulation must be kept protected and dry.

#### Special Note:

48" x 48" insulation boards may be mechanically fastened or adhered to the substrate. 48" x 96" insulation boards are to be mechanically fastened to the substrate. The use of bitumen or adhesive attachment for boards larger than 48" x 48" is not recommended.

### BASE SHEETS

Industry practice recommends that a base sheet sometimes be used as the first ply of a roofing membrane, such as in the case of nailable decks,

acoustical metal decks, cementitious wood fiber (Tectum) or when substrate venting may be desired. Depending upon the application, these base plies may be either organic or glass fiber materials. When a warranty is required, approved base sheets must be used.

When a base sheet is required as the first ply in a solid mop specification, it should be embedded in a solid mopping of steep asphalt and broomed into

At no time shall a base sheet, used as the first ply of the primary roofing membrane, be left exposed or used as a temporary roof.

place.

When mechanical fastening of the base sheet is required, install approved fasteners 9 inches on center along the laps and stagger nail, in two (2) rows, down the center of the base sheet on 9 inch centers.

Depending on the particular application, special fasteners and/or plates may be required to meet the installation guidelines of Factory Mutual or certain local code bodies.

### REROOF / RECOVER APPLICATIONS

If reroofing requires complete removal of all existing roofing materials, treat the application as you would a new building. If conditions dictate that complete removal of all existing materials is not possible (e.g roof membrane, insulation, etc.) consult your Durapax representative.

### MATERIAL PROTECTION

All materials must be kept clean and dry prior to their installation. Materials must be stored off the ground and adequately covered with breathable tarpaulins. For longer periods of storage, the materials should be properly warehoused.

Rolls should be stored on end in a standing position with the labels right side up. Plastic covers and shrouds used for shipment should be removed prior to tarping when received. Areas of material which become accidentally damaged should be cut out before the material is installed.

### DECKS

All decks must be installed in accordance with their manufacturers' specifications, be structurally sound, and be designed to accept live and dead loads including the desired roofing system.

Consideration must be given to movement and the need for expansion joints.

Excessive deck deflection can cause a roof system problem. Durapax recommends following the guidelines for maximum allowable deck deflection published by the National Roofing Contractors Association.

All deck surfaces must be reasonably smooth, clean and dry before starting insulation/membrane application.

**NOTE: Care must be taken to design a deck system which reduces the potential for bitumen drippage. Durapax will not accept responsibility for improperly designed deck systems, bitumen drippage, migration or membrane slippage.**

The following are additional design requirements applicable to individual deck types. These comments, however, should not be the only considerations when specifying a membrane over the designated deck. The designer/specifier should consult all available information before committing to a final specification.

#### Steel

- Design to comply with deck manufacturer's specification.
- Comply with Steel Deck Institute procedures.
- Be 22 gauge or heavier.
- Consult Factory Mutual (FM) Data Sheet 1-28 on recommendation for maximum spans.
- Deck must be permanently attached to the structural framing.
- When acoustical metal decks are used, to reduce the potential for bitumen drippage, the roofing system must include a dry sheet on the deck and the first ply of the membrane system must be a base sheet set in steep asphalt.
- All decks must be covered by at least one layer of mechanically attached insulation, which

should meet as a minimum, FM 1-60 requirements. Durapax will not be responsible for damage caused by fasteners, lack thereof, improper attachment, or bitumen drippage.

#### Wood Decks (Plywood/Plank)

- Comply with Dept. of Commerce Standards PS 1-74.
- Design and install in accordance with the American Plywood Association. Grade C-D or better.
- Secure to structure with annular threaded or ring shank nails.
- When possible all joints should be supported.
- Cover installed deck with rosin sized sheathing paper (scatter nail).
- When insulation is used, it may be mechanically fastened over the red rosin paper or base sheet, or insulation may be installed in steep asphalt or adhesive over the mechanically fastened base sheet.

#### Gypsum/Lightweight Insulating Concrete Decks

- Install in accordance with the deck manufacturer's recommendations.
- Steel deck should be 28 gauge corrugated or heavier.
- An approved base ply should be mechanically fastened to the deck with approved fasteners.
- Provision must be made for venting to the outside on newly installed lightweight insulating concrete.
- The membrane or insulation should never be installed directly to these type decks with bitumen or adhesive.
- If board type insulation is required, install it in approved Insulation Adhesive or hot bitumen over the mechanically fastened asphalt base sheet.
- Application of board type insulation is not recommended over newly installed lightweight concrete substrates.

#### Structural/Precast Concrete Decks

- All joints or cracks must be even, filled with

grout and stripped with organic felt set in asphalt flashing cement to prevent bitumen drippage.

- Follow the recommendations of the Precast Concrete Institute (for panel applications).
- Install deck in accordance with the manufacturer's specifications.
- At least one layer of roof insulation is required over precast panel applications.
- Prime deck with appropriate primer.
- When using insulation, prime deck with asphalt primer and set boards in full moppings of hot steep asphalt.
- Mechanical fastening of insulation is optional.

#### Structural Wood Fiber Decks

- Install deck in accordance with deck manufacturer's specifications.
- All deck joints should be even, grouted and sealed with organic felt stripping set in asphalt flashing cement.
- Cover deck with 1 ply organic base sheet mechanically attached with approved fasteners.

With structural wood fiber decks, a minimum layer of approved insulation is required. A base sheet should be mechanically attached to the deck with approved fasteners and the insulation installed in a full mopping of steep asphalt. As an option, the insulation may be mechanically attached to the deck over a loose laid rosin paper with approved fasteners. A base sheet mopped in steep asphalt is required as the first ply of the membrane system installed over structural wood fiber decks.

#### EXPANSION JOINTS

Roof areas that extend farther than 200 feet in any direction normally require the use of expansion joints which extend across the entire width of the roof. The expansion joint must not terminate short of the roof edge or perimeter. The expansion joint should be designed to accommodate contraction as well as expansion. In addition, the expansion joint should be constructed to a raised height of 8 inches above the roof line. Water drainage should never be obstructed by the expansion joint, and drainage should never be attempted through or

over an expansion joint.

Expansion joints should be provided:

Wherever expansion or contraction joints are provided in the structural system.

Where steel framing, structural steel or decking change direction.

Where separate wings of "L", "U", "T", or similar configurations exist.

Whenever additions are connected to existing buildings.

At junctions where interior heating conditions change.

Where movement between vertical walls and the roof deck may occur.

### CANTS

At all intersections of vertical and horizontal surfaces, such as walls, equipment curbs, expansion joints, etc., install a 45° cant strip, providing a four (4) inch rise above the roof's surface. Consult Flashing Specifications for specific details. Although a treated solid wood cant is preferred when a cant strip is needed, wood fiber or perlite cant strips are acceptable in warranted applications.

It is recommended that the wood fiber or perlite cant be installed in asphalt cement to avoid bitumen drippage. The solid wood cant is to be mechanically attached with approved fasteners. Care must also be taken to avoid bitumen from entering the building at such edge details.

### FELT APPLICATION

All plies of the built-up roofing system must be solidly attached in hot bitumen. In no place shall one ply of felt touch another. All felts will be laid shingle fashion overlapping the previous sheet 24-2/3 inches for a 3 ply membrane and 27-1/2 inches for a 4 ply membrane. End laps should be no less than 10 inches and staggered. The total membrane system must be completed at one time. All felts must be pressed or broomed into the bitumen while it is at its EVT to insure total adhesion.

At the intersection of all vertical and horizontal surfaces, such as walls, equipment curbs, expansion joints, etc., all felts must extend to the top of the cant strip but no further than two (2) inches above its top edge. Care must be taken to assure that all plies conform as tightly as possible to this configuration.

### PITCH APPLICATION

Whether applied by mop or mechanical spreader, the coal tar pitch must be sufficiently hot to adhere the felt. It must not, however, be heated to temperatures greater than the following guidelines.

Application and Heating Temperature Guidelines		
	Heating Maximum	Point of Application
Product	°F	°F
Coal Tar Pitch ASTM Type I	400°	360° ±25

Note: Kettle temperature should not exceed 325 ° F if material is not being used and replenished. This is for jobsite use, and should material not be used in 4 hours the kettle should be shut down.

It is extremely important that all interply moppings be as thin as practical, but continuous without interruptions or voids. Heavy moppings can contribute to roof slippage.

Pitch weights can vary within a membrane. Experience has demonstrated that an interply mopping, averaging not less than 20 lbs. per 100 square feet is adequate for a membrane assembly.

The top pour of pitch used to embed the gravel surfacing, should average no less than 70 lbs. per 100 square feet.

These figures are offered only as a guide and can vary depending upon many factors. Actual experience by the contractor must be considered when estimating project requirements.

## BITUMEN CONTROL / ENVELOPES

Envelopes can be installed using two plies of non-perforated organic felt or polyester reinforced smooth membrane suitable for use as an envelope. The envelope should be a minimum 18" wide, or can be wider if needed to cover the juncture between the nailer and insulation. It should be in-

At all horizontal edge details such as gravel stops, raised edge perimeters, vent pipes, pitch pockets etc. a 2 ply felt envelope or some other type of pitch dam must be provided to avoid bitumen drippage or bitumen migration from between plies. Durapax will not be responsible for bitumen drippage or migration.

stalled in a solid trowelling of approved asphalt mastic or a solid mopping of steep asphalt. Half of the envelope should extend beyond the edge of the roof. After membrane installation the extended portion should be folded back over the completed membrane and embedded in approved asphalt mastic prior to setting of the gravel stop in a bed of asphalt mastic. After metal is secured, remove excess envelope extending past metal prior to striping.

## AGGREGATE SURFACING

Before top pouring the membrane with pitch and embedding the aggregate, the roof membrane must be inspected to determine that all felts are laying smooth and foreign materials have been removed.

To obtain the desired top coating of pitch, it should be applied either by pouring or through a mechanical applicator designed and regulated for this purpose. The aggregate used shall be reasonably clean, dry and meet the specified ASTM standard (ASTM D-1863). The aggregate must be spread into the top pour while it is still hot enough to achieve the required bonding.

**A light colored aggregate is recommended. Limestone is not acceptable.**

Recommended Aggregate Amounts

Gravel 400 lbs. per 100 sq. ft. (average)

Slag 300 lbs. per 100 sq. ft. (average)

## COLD WEATHER APPLICATIONS

Warm and dry weather conditions are ideal for installing built-up roofing systems. If, however, schedules require that the roof system be installed at temperatures below 45 F, specific procedures should be followed. In any case, weather conditions must be free of moisture (e.g. dew, rain, frost, snow, ice). When colder conditions exist, roofing bitumens set up more quickly. Precautions must be taken to be certain the temperature of the bitumen, at the actual point of application, complies with the specified requirements without over-heating the material.

Insulated equipment may be required to achieve the desired results. Special care must also be taken to assure that all roofing felts are totally embedded at the bitumens point of application temperature. Installing the roofing bitumen at colder than desired temperatures can result in the use of greater amounts of material which can lead to potential roof slippage.