Installing a Rubber Roof

Forget the mess of roll roofing—for flat or low-slope roofs, EPDM membranes are the way to go

by Rick Arnold and Mike Guertin

Unrolling the membrane for a dry fit. After the substrate has been prepared properly, the sheet of EPDM is laid out in the area to be covered for a dry fit.

Putting down a fully adhered membrane
A sheet of cured membrane is glued to the roof deck and wall with contact cement. A length of aluminum trim stock covered with membrane secures the edge of the EPDM where it overlaps the edge of the roof shingles. The decking is attached to sleepers atop EPDM chafing strips.

Not long ago, we'd cringe whenever we'd get a job that had a flat roof or a roof with a really shallow pitch. Add a couple of extra details such as a 6-ft. French door opening onto a wooden deck over the roof with kneewalls on two sides, and we'd hear voices screaming in our sleep: "I'm going to leak, I'm going to leak."

The only way we could guarantee a watertight job was to have a copper roof pan fabricated to cover the flat part of the roof. But copperwork ain't cheap, and we'd still have to do some fancy flashing. In most cases we were forced to fall back on that old inferior standby, roll roofing. Because of roll roofing's poor track record, we always left the homeowners a bucket of tar at the end of the job. Eventually, they'd need it.

Then, about eight years ago, we installed our very first EPDM (ethylene propylene diene monomer), or single-ply rubber, membrane on a large flat roof, and since then the voices of doom have all but disappeared. Rubber roofing, used commercially for many years, is now finding its way onto more and more residential projects (*FHB* #64, pp. 43–47). Properly installed, a rubber roof can solve even the most difficult flashing details. And unlike with roll roofing, we've never been called back for a rubber-roof job that leaked, even on oceanfront projects that experience gale-force winds on a regular basis.

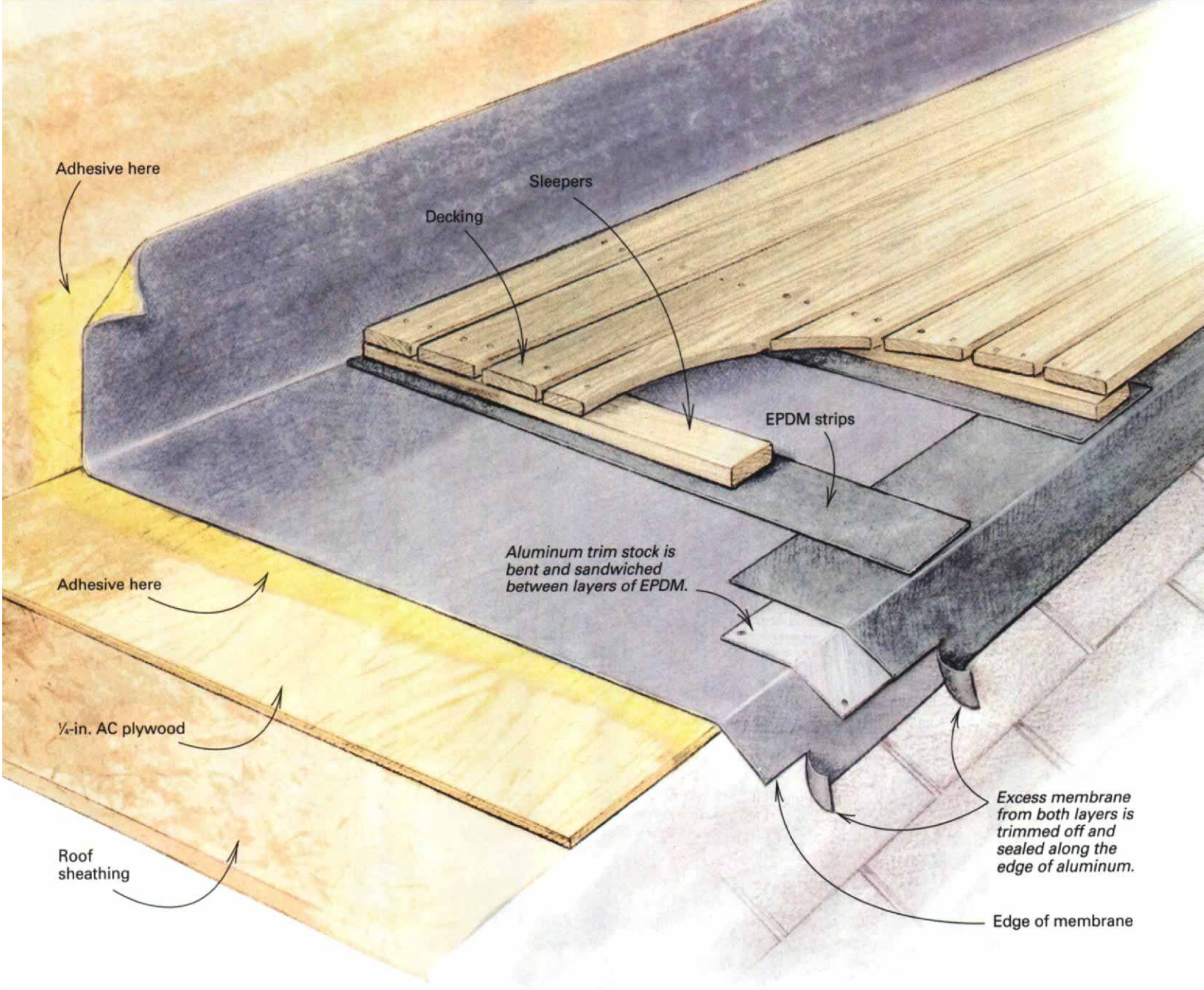
EPDM membrane is sold by the yard- There are many different systems for installing EPDM membranes, including loose-laid and ballasted (where the membrane is put down without being attached directly to the roof); mechanically fastened, hot-applied fully adhered (also known as the torch-down system); and fully adhered. Each system has different performance characteristics that make it suitable for specific applications.

We primarily use the fully adhered system for installing rubber roofs (drawing above). This system is the most cost effective and easiest for us to install by ourselves on the small-area roofs that we're asked to do most often. Fully adhered installation systems don't require special tools, and decks can be installed on top of them.

The first task is determining how much and what kind of rubber-roof membrane a job requires. The membrane we buy from a local roofing-supply company typically comes in 10-ft. by 50-ft. or 10-ft. by 100-ft. rolls, although some manufacturers offer various lengths and widths. For a small job such as the one in this article, we pay a few cents more per square foot to get the membrane cut to the length we need. The extra cost is offset by not having a lot of leftover material.

The membrane is also available 0.045 in. thick or 0.060 in. thick. However, for a fully adhered system, manufacturers recommend the 0.060-in.

Drawings: Dan Thornton



membrane because a tiny bit of the membrane is supposedly dissolved when the adhesive is applied. Also, for a job that's going to see traffic or have anything put on top of it, the extra thickness is insurance against roof failure.

EPDM also comes either cured or uncured. The membrane that covers most of the roof is made of cured rubber, which is stiffer and stretches less than uncured rubber. Uncured membrane is sold in narrower strips with a peel-off backing. Uncured membrane is flexible so that it can be stretched around comers and over seams to flash in the membrane and make it continuous and leakproof. But uncured membrane will also deteriorate over time when left exposed, so we use as little as possible.

The work area as well as the substrate must be kept clean—Before measuring and cutting the membrane, we prepare all areas that will receive the rubber membrane, including the flat roof, intersecting walls, door thresholds, adjoining roof sections and in this case, kneewalls. All sheathing must be securely fastened, and all fasteners have to be sunk flush or below the level of the sheathing. We also check for sharp edges that might puncture the membrane.

The list of substrates approved by EPDM manufacturers includes plywood, OSB, wood planking and even lightweight concrete. Most EPDM membranes can also be installed over polyisocyanurate insulation board and high-density fiberboard panels placed over just about any other type of solid substrate. Insulation panels are also available in different thicknesses for different R-values, and they are often sold by the same manufacturers that make EPDM. On this job, insulation was not required, but the OSB roof deck had been exposed to the elements for a while, and the many loose surface flakes would have compromised a connection with the EPDM. To give us a fresh surface for the best bond with the EPDM, we screwed down a layer of ¼-in. smooth-sanded plywood on top of the OSB,

As a final preparation, we give the substrate a good sweeping or vacuuming. All areas that will come in contact with the membrane must be free of dirt, dust and debris. The membrane itself has to be kept clean. Any small particles that get trapped under the membrane may cause it to fail prematurely.

We also prepare a large open work area for measuring and rough-cutting the membrane. For this project our work area was the plywood subfloor of a large room just inside the future rooftop deck. After taking rough measurements of the deck and the adjoining kneewalls, we carefully rolled out the membrane and cut it to the approximate size. This roof deck was around 13 ft. wide, including the foot or so that we let extend

Membrane is not glued down all at once. The adhesive for attaching EPDM is a type of contact cement. Folding back the membrane into smaller sections makes it easier to apply the glue and to stick down the membrane.

Where the rubber meets the roof. After the adhesive has dried, the crew unrolls the membrane slowly, making sure no wrinkles or air bubbles remain. Once it's unrolled, every inch is pressed down to ensure good adhesion.

over the roof shingles and the extra couple of feet that run up the walls. Because the membrane came only 10 ft. wide, a second piece would be needed to finish covering the roof.

Corner cuts don't have to be precise—We sweep the roof area one last time and then lay the large cured-rubber membrane down for a dry-fit trim (photo p. 94). Scissors or a razor knife works great for this part. We're not too fussy when it comes to trimming the extra membrane at the various comers. Those areas will be covered with additional layers of flexible uncured rubber. And if a wrong cut or an accidental tear is made, the membrane can be added to and repaired easily. Rubber roofing is forgiving.

We glue the membrane to the deck floor before gluing it to the kneewalls. So once the trimming is complete, we prepare for the glue-down by keeping the membrane in its dry-fit position and folding the material back in 2-ft. to 3-ft. increments from one edge. We try to work with only a small section of membrane at one time so that it's easy to reach both the substrate and the membrane when spreading the adhesive (photo above left). For this job, we first folded back the material that was going to run up one of the kneewalls. Then we folded back an additional 3 ft. or 4 ft., exposing the first section of roof deck along that kneewall.

We use two adhesives for gluing the membrane, both of which are contact cements. One adhesive is for gluing EPDM to the substrate. The other type that we use later can also be used to glue EPDM to itself. To prevent problems with incompatible materials, we always use adhesives specified by the EPDM manufacturer.

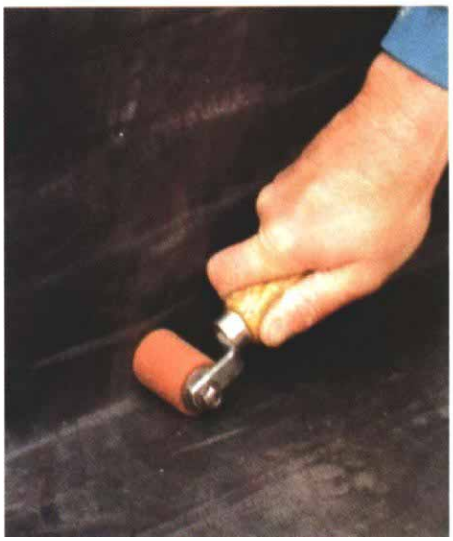
We begin our glue-down by applying adhesive to the exposed portion of the deck with a paint roller. We brush the glue onto the comers as well as under the fold of the membrane to make sure we get proper coverage. Next, adhesive is applied to the membrane that was exposed when it was rolled back. We always double-check the coating on the edge of the fold to make sure there are no voids.

The two surfaces are ready to be mated when the adhesive has dried to the touch. The adhesive dries more slowly the heavier it's applied, and bonding the membrane over wet adhesive causes the membrane to bubble. So we always make sure the thickest areas are dry before proceeding. At that point the membrane is rolled back down slowly (photo above right).

The surfaces bond immediately and permanently as soon as they touch, so we try to smooth out wrinkles or air pockets as we go. Most of the smoothing is done with the palm of the hand, but we also use a small roller to press down stubborn spots. When the membrane is stuck down as far as the kneewall, we tack the kneewall flaps loosely in place and press the membrane into the corner with a roller (photo left, facing page).

Next we go to the opposite wall and fold up the rest of the membrane until the next section of the roof deck is exposed. Because the membrane is the farther away of the two surfaces, we kneel on the substrate and spread the glue on the membrane first and then spread the glue on the next section of roof deck. After the second section is pressed down, the process is repeated until we reach the other edge of the roof deck. We let the excess membrane run out onto the roof shingles to be dealt with later.

Membrane continues up the kneewalls— On the job featured here, we put the membrane down on a cold day in November, and cold tem-



A roller presses down the corner. After tacking the flaps of kneewall membrane up out of the way, a roller is used to press the EPDM all the way into the corner between the deck and the kneewall.

Working two areas at the same time. Because chilly weather slows drying time, adhesive can be spread on the first kneewall while the glue on the last deck area is drying in the foreground.

peratures slow the adhesive's curing time. So while we were waiting for the adhesive to dry on the last section of roof deck, we began prepping the kneewall on the opposite side.

With kneewall flaps tacked in place, we trimmed off excess membrane in a level line around 18 in. up the wall. Then we drew a pencil line along the top edge of the membrane so that we knew how far to spread the glue. The kneewalls on this job were sheathed in OSB, but we weren't concerned about minor flaking of the board. The membrane was to be covered with sidewall shingles that would help to hold it in place.

After we spread the glue on the kneewall (photo above right) and the EPDM flaps, we had to be very careful with the flaps while they were drying. The kneewalls had an angled jog to them so that when the flaps were folded back down, they overlapped and had to be kept apart while the glue was drying. To separate the two flaps, we draped one of the sections over a short piece of 2x placed on edge.

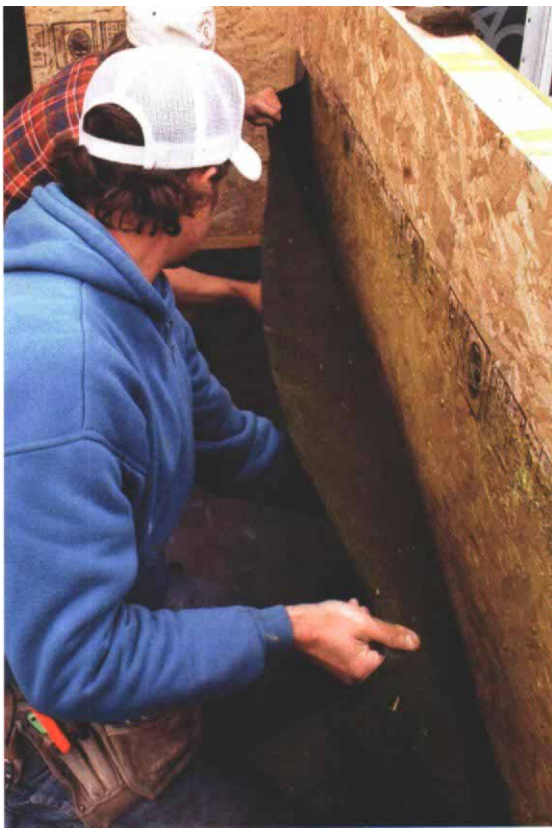
While we were waiting for the glue on the first kneewall to dry, we stuck down the last part of the roof deck and spread glue on the other kneewall. We began sticking down the kneewalls by making sure the membrane was pushed all the way into the corner between the roof deck and the kneewall (photo bottom right). Some projects call for a wooden cove to be installed in the corner, which creates a softer transition between floor and walls. Then we worked the membrane up the wall slowly one flap at a time. When the membrane on the walls was completely stuck down, we pressed the membrane into the corners with the roller.

Deck membrane is finished with a splice-

As we mentioned earlier, the membrane stock was not wide enough to cover the roof with its overlaps onto the roof shingles and the wall of the house. So our next step was splicing on a second piece of EPDM to complete the roof.

We like to have at least a 6-in. membrane overlap, so we measured out that distance from the edge of our first piece and snapped a line. Then we measured from that line to the corner and up the wall about the same distance as our kneewall coverage. We swept the work area again and cut out the membrane we needed.

As with the first piece of EPDM, we dry-fit the splice, aligning it with the line we'd snapped for



Working from the bottom up. When pressing the kneewall membrane into place, the top portion is held away while crew members start from the bottom corner and work their way up.

Splice is glued to the wall first. A small piece of EPDM had to be spliced in to complete the roof. But because a different adhesive has to be used where the two sheets overlap, the membrane is glued to the wall first.

Rubber-to-rubber glue for the overlap. A special contact cement glues down the overlapping area of the splice. The small dabs on the face helped to stick the membrane up out of the way while the glue was drying.

the overlap. Because the first piece came within a couple of inches of the house wall, we cut our splice piece to fit between the kneewalls, eliminating a difficult corner detail. The small strip of kneewall left exposed would be covered with the uncured EPDM flashing. We marked the door opening on the EPDM so that we spread only enough glue to wrap the step and the threshold.

For the splice we applied the membrane in reverse, gluing the membrane to the house wall first (top photo). Then we applied rubber-to-rubber adhesive to both sides of the overlapping membrane (bottom photo). To keep the splice membrane off the deck membrane while the glue was curing, we put dabs of glue on the top side of the splice and a thin line of adhesive along the membrane on the house wall. These cured quickly and let us temporarily stick the splice out of the way while the glue was applied. Once the splice was glued down, we made diagonal cuts from the outside corners of the door threshold and wrapped the flaps around the door framing and threshold.

Roof-shingle intersection gets special treatment—Typically, EPDM membranes terminate at the edge of a roof and lap over onto the rake or fascia boards. In these cases, we use a factory-supplied aluminum termination bar to fasten down the membrane edges. A termination bar is a piece of mill-finished aluminum stock ⅛ in. to 3/16 in. thick and about an inch wide that is fastened down with screws through predrilled holes (about 12 in. o. c.) over the edge of the membrane to prevent it from lifting in the wind. Roof cement seals the termination bar to the membrane and the membrane to the rake or fascia.

On this rubber roof, the membrane extended over the shingles. Because it's difficult to get EPDM to adhere to roof shingles and because a termination bar didn't seem like an appropriate finishing touch, we used a different detail to end the membrane, known as babing (drawing pp. 60-61). We bent a length of flat aluminum coil trim stock about a foot wide to the same angle as the intersection of the rubber roof and the shingles and then aligned the bend over the intersection. We bedded the trim stock in roof cement and attached it by driving screws every foot or so along both edges.

With the aluminum trim stock fastened down, we trimmed the excess rubber membrane by running a razor knife along the edge of the aluminum, taking care not to cut the shingles. We then glued down the last piece of cured membrane on top of the aluminum, lapping back onto the bottom layer of rubber roofing and creating an attractive transition onto the shingles. On this job we let this piece of membrane also run up and wrap around the ends of the kneewall.

Uncured rubber flashes the corners—With all the cured membrane installed, we used uncured rubber to cover and seal the EPDM we cut to fit various comers. Uncured rubber comes in rolls with widths of 6 in. to 2 ft. Uncured rubber is flexible and can be stretched easily to conform to different contours. It comes with a backing that gets peeled off just before the adhesive is applied (photo top left, facing page).

We cut lengths that extended a few inches longer than the areas we wanted to cover. We then trimmed all corners round, which prevented edges of the uncured strip from snagging and lifting up after it was glued in place. We glued down the uncured rubber strips with the rubber-to-rubber adhesive we used for splices in the roof-deck membrane.

As we did with the membrane, we applied adhesive to both surfaces. We first peeled the backing off the strip, then laid it with the peeled side up on a small piece of plywood or OSB that let us spread the adhesive without having to be careful about coating surrounding areas (photo bottom left, facing page). Once the surfaces were dry, we made contact with one side of the strip, then pulled and stretched it to conform to the detail (photo top right, facing page). We used the small roller to smooth wrinkles or air bubbles.

Some details, such as kneewall ends, take more than one layer to ensure coverage. The order in which the layers go down doesn't really matter as long as the entire surface-especially the edges—is covered and fully adhered.

Deck boards float atop the membrane—After the membrane was installed with all the corners sealed with uncured EPDM, we sided the house and the kneewalls. We lay a sheet of plywood or OSB over the membrane to protect it while we work. Siding is kept ½ in. off the roof-deck membrane to prevent wicking of moisture.

In this case we nailed the shingles at the normal location 6 in. up from the butts. The shin-

gles do double duty as they help to hold down the top edge of the EPDM. On retrofit jobs we remove the bottom three or four courses of sidewall shingles and then lap the rubber roof up the wall before replacing the siding.

The final step in completing the membrane is sealing all edges where one layer of rubber overlaps another. This procedure is usually done before the siding is installed, but the supplier was out of edge sealant. So we went ahead and installed the siding before sealing the edges to keep the job moving. We always use an edge sealant provided by the EPDM manufacturer that comes in a caulking tube. We cut the tube for about a ¼-in. bead, then neatly seal all exposed edges (photo bottom right).

The final plans on this project called for a deck to be installed over the rubber roof (drawing p. 61). Although EPDM can be installed over a flat roof, we pitched the roof to ensure adequate drainage from beneath the deck by tapering the rafters ⅛ in. per ft. Another option would have been framing the roof flat and installing tapered polyisocyanurate panels to achieve the desired pitch. These panels are available from the EPDM manufacturers in ⅛-in.-per-ft., ¼-in.-per-ft. or ½-in.-per-ft. slopes, and are put underneath the EPDM.

We usually secure the decking to sleepers that float on top of the rubber roof. We cut chafing strips from the leftover EPDM membrane slightly wider than the sleepers and lay the strips on the membrane beneath where the sleepers will sit. These strips are not glued down and give the roof membrane added protection from abrasion due to movement in the sleeper/deck assembly.

We double-checked the length of our fasteners before attaching the decking to be sure they didn't penetrate the sleeper and punch holes in the membrane. Generally, we do not have to fasten down rooftop decks, relying instead on their weight to hold them in place. If we are concerned about movement, we fasten the deck with steel straps to the sidewall and/or the fascia over the termination bar. We never fasten through the roof membrane.

Here in the Northeast, there is a concern about water problems from wind-driven rain or snow building up at the sills of doors that open onto rooftop decks. So when we frame the opening for the door, we try to keep the curb high enough to put the door sill several inches above the finished decking. Nailing on a riser board beneath the door may also invite leaks, so we usually omit the riser, leaving extra space to let rain or melting snow drain away easily. □

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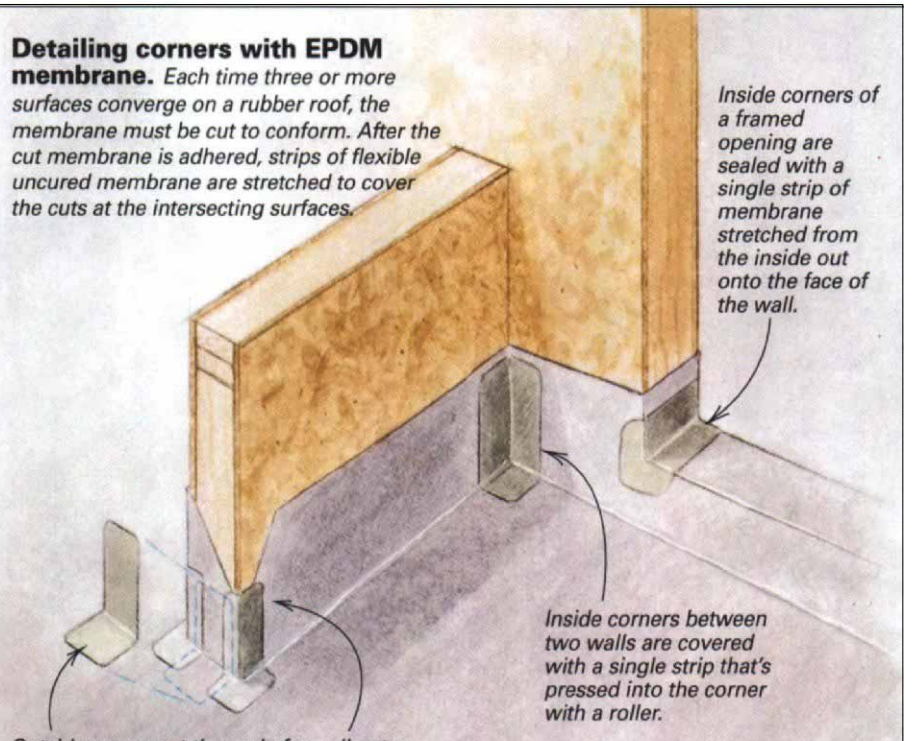
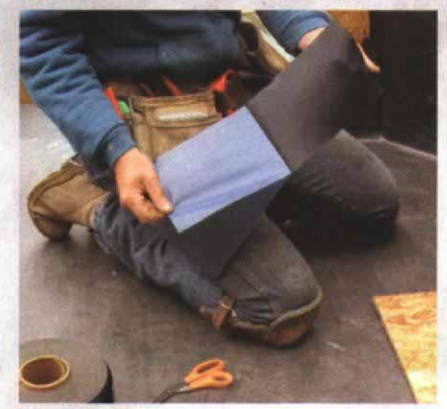
Detailing corners with EPDM membrane. *Each time three or more surfaces converge on a rubber roof, the membrane must be cut to conform. After the cut membrane is adhered, strips of flexible uncured membrane are stretched to cover the cuts at the intersecting surfaces.*





A peel-off backing keeps the membrane clean. A protective backing peels off the uncured membrane just before adhesive is applied.

Uncured rubber stretches around corners. The flexibility of uncured rubber lets it stretch to conform to just about any corner shape.

Wood scrap keeps glue where it belongs. Uncured rubber strips are laid on a scrap of wood to protect the surrounding area from glue.

Caulking seals every edge. As added insurance against membrane failure, a bead of caulking is run along every exposed membrane edge.

Photo bottom right this page: Rick Arnold and Mike Guertin