Historical Information

The use of ***gutters***, or ***eaves troughs***, dates from early colonial times when two boards were nailed together to form a functional V-shaped trough placed below the drip edge of the roof and held up with wooden brackets. *(Fig. 1)*

As architectural designs became more sophisticated, the trough was removed and built-in behind

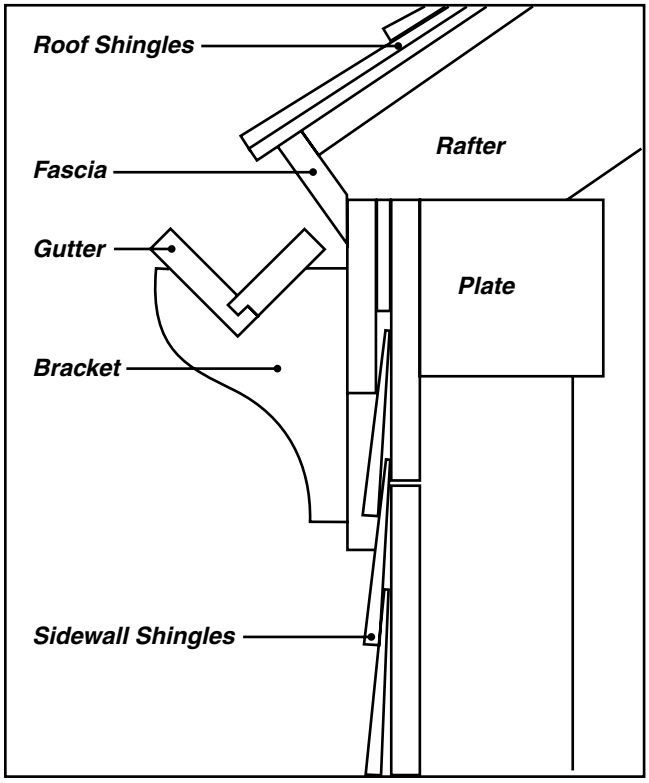

Figure 1: Section Through "V" Trough Gutter Colonial Period

the behind the crown molding at the edge of the roof line, where it was lined with sheet lead or copper, and soldered to make it water tight. In this way the gutter was hidden, serving its function without compromising the molding lines of the exterior cornice. *(Fig. 2)*

As an alternative to a wood crown molding with a lined trough, the entire gutter could be fabricated of sheet metal, bent on a cornice brake around wooden formers in such a way as to create a sheet

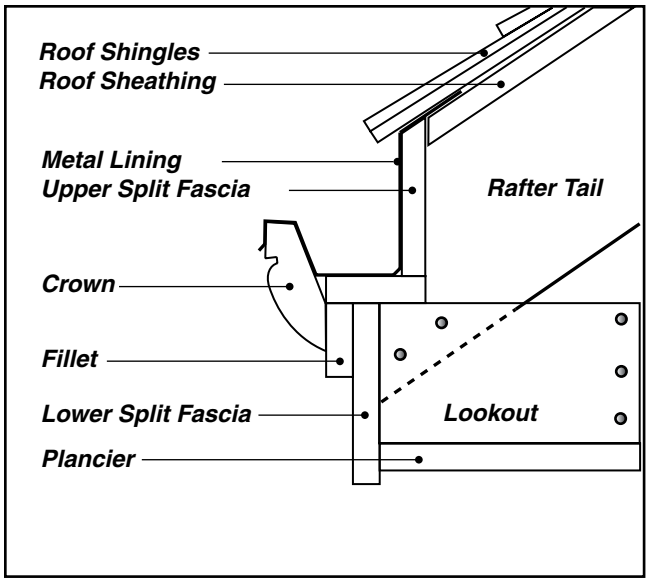

Figure 2: Section Through Metal Lined Gutter Greek Revival Period

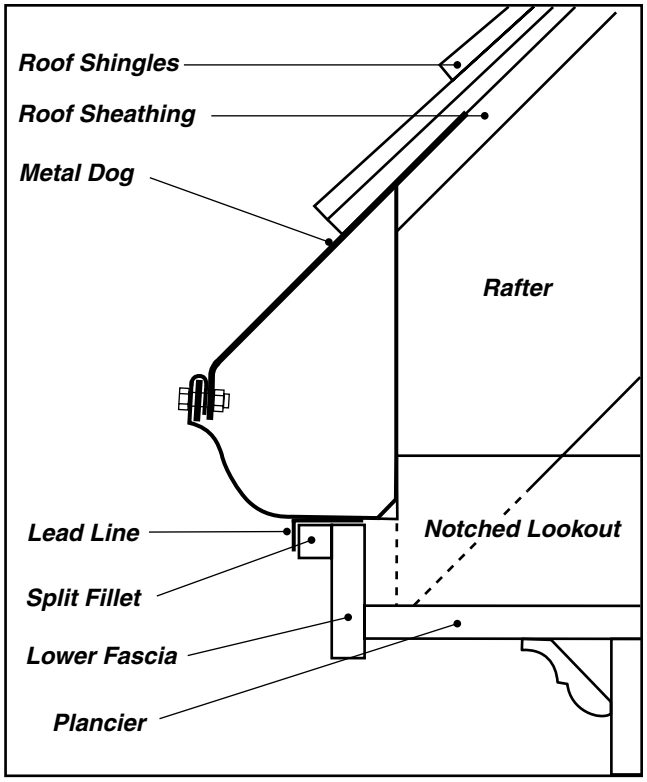

Figure 3: Section Through Sheet Metal Gutter - Victorian Period

metal replica of the wood moldings. *(Fig. 3)*

By the latter half of the 19th century, one-piece milled wood gutters were generally available in

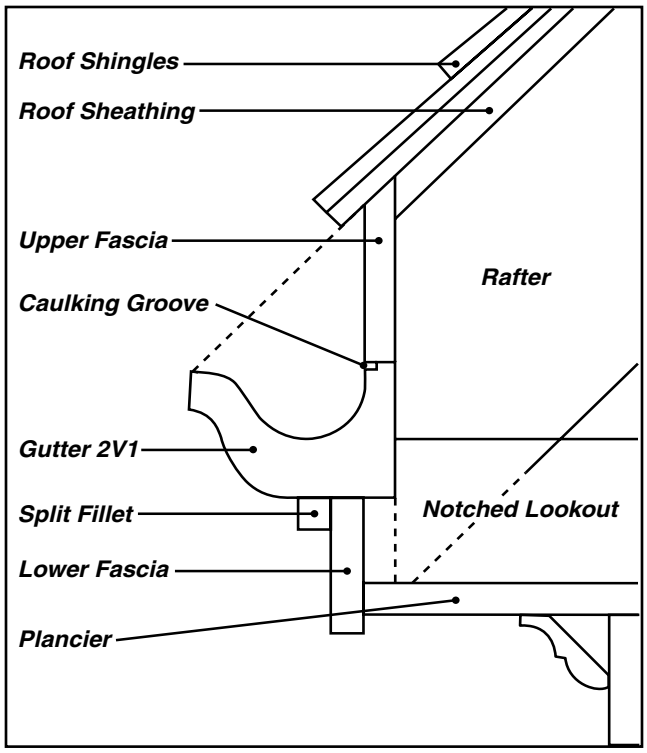

Figure 4: Section Through Eaves Showing Boston Pattern Milled Wood Gutter - Victorian Period

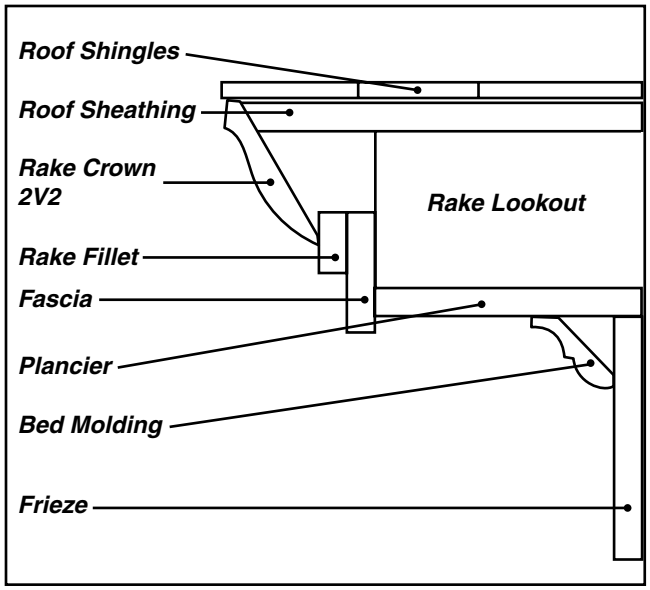

Figure 5: Section Through Raking Cornice Showing Boston Pattern Rake Crown Configured For Rake Miter - Victorian Period

the Boston area. A crown molding pattern, typically the Roman ogee, was milled on the face of the gutter, and a trough milled into the top. The gutter could be nailed in place and the joints made water tight with lead flashing and roof cement. This work could be done by a carpenter without the additional services of a sheet metal worker, a savings of time and money.

As an architectural element, the wood gutter, like the earlier ***lined gutter***, was built into the framework of the cornice. Properly installed, the face of the gutter appeared as a crown molding in the arrangement of elements that made up the traditional cornice. Since the gutter was deeper in cross section than a crown molding, it was necessary to adapt the frame at the ***rafter tails*** to accommodate the gutter. In most original applications, the gutter was nailed directly to the rafters, and the ***fascia board*** was split, with an upper fascia nailed to the rafter tails, and a lower fascia that was built out to the plane that it would normally occupy on a typical cornice. *(Fig. 4)*

With gable roofs, the gutter would miter to ***raking crown moldings*** at each gable. The joint between the gutter and the crown molding at the gables is called a ***rake miter***. In other applications the gutter would join to horizontal ***belt moldings*** of the same profile as the gutter itself.

A ***true rake miter*** requires a pair of complementary moldings, the rake crown profile being developed from the horizontal crown molding or gutter profile. *(For an introduction to the geometry of cornices, please refer to section 1: Crown.)* As a result, the layout of the raking cornice at the gables is different from the corresponding eaves cornice. *(Compare Figures 4 and 5)*

By the later Victorian period, most frame houses in the Boston area were using milled wooden gutters. The complex roof lines associated with the Queen Anne style employed a variety of roof pitches, turrets, cross gables, and other features. Tying these elements together were the gutters,

rake crowns, and belt moldings that capped the upper edge of the walls and gables.

Sometime about the year 1880 mills began altering the traditional "S" curve of the Roman ogee in a way that made it possible for a single pair of gutter and rake moldings to do the job of developing a true rake miter regardless of the pitch of the roof. These original ***Boston pattern*** gutters and rake moldings, with minor modifications, became the regional standard for the remainder of the Victorian and Colonial Revival periods. During this time large quantities of highly decay resistant Gulf cypress were shipped from the deep South to New England and machined into gutters and related patterns. Standard sizes ranged from 3x4" to 6x10".

As stands of old growth cypress were depleted, mills turned for supply to West coast lumber species, particularly Douglas fir. Although there are still original installations of 19th century cypress gutters in service today, most of these were replaced starting in the 1950's and '60's, giving the wood an effective life span of fifty to one hundred years, depending on effective maintenance.

Section 2 contains an assortment of solid wood gutters, heavy crowns for lined applications, and developed rake crowns. These profiles represent a range of architectural periods, from the Colonial through the Greek Revival and up to the end of the Colonial Revival , a total span of more than 200 years.

Original Boston pattern 3x4" and 4x6" gutters *(A.T. Stearns Mill numbers 1001 and 1012 respectively),* together with related moldings are kept in stock at all times for the convenience of builders working in traditional styles.

All radius gutters are made to order, either to a specified radius, or in the cases of an ellipse or eyebrow, to a template. When replacing radius gutters, the best method is to remove a full length section of the old gutter and bring it to the mill.

Technical Information

Note: *The following information pertains to the installation of wood gutters on historical structures. The installation details and methods described may not conform to current local building code requirements. Check with your local code authority before beginning any work subject to a building permit.*

Most code jurisdictions require the incorporation of continuous eave vents in the design of new construction. (Fig. 8)

BASIC LAYOUT REQUIREMENTS

Historical wood gutters are designed to be nailed directly to the rafter tails. They are not designed to be installed over a fascia board, or over spacing blocks. *(Fig. 4)* This arrangement allows the gutter to be recessed into the eaves structure, and provides for drying of the back of the gutter between rains. Gutters will be attaching to rafter end wood, requiring longer spikes to compensate for the diminished nail holding capacity of end wood. Before beginning any retrofit installation, check the soundness of the rafter tails. Deteriorated rafter ends should be sistered, preferably with decay resistant lumber.

The basic layout rule is that the gutter overflow ***lip*** (the upper tip of the gutter along the outside edge) must be in line with the inclined plane of the top of the roof sheathing on any pitched roof. *(See dotted line on Fig. 4)* The plane is the surface to which the roofing material is attached. The alignment must be maintained at all points where the guttering will intersect with a gable. Holding this alignment allows the gutter to intersect with the rake molding at any gable, since the upper tip of the gable rake molding will line up with both the lip of the gutter and the top of the roof sheathing. Some carpenters prefer to raise the gutter about 1/4" above this line, which in turn elevates the

rake crown about 1/4" above the roof sheathing. This creates a slight back-pitch to the shingles at the gable edge and reduces water drip over the edge of the gable.

PITCHING OF GUTTERS

Once the gutters are aligned at the gable corners, the middle of the gutter run may be raised slightly to give it pitch. The purpose of the pitch is to allow the gutter to dry out between rains. Only a slight pitch is needed to do this, typically ½" to ¾" over the total run. This degree of pitch is not designed to help convey debris towards the downspouts. Since the leaves and other organic material that collect in gutters will not drain out on their own, gutters must be cleaned manually at least once a year.

Unlike wood gutters, which require a pitch to prolong their working life, copper gutters and wood gutters lined with sheet copper are installed level. The outlet tubes in copper gutters are raised at least ¼" above the bottom of the gutter to help hold a layer of water in the bottom of the gutter trough. The presence of standing water in copper gutters does not adversely affect the metal, and mitigates the effects of atmospheric acidity in industrial regions.

RAKE MITERS

Before beginning any job in which gutters intersect rake crown moldings, be certain that the rake profile has been correctly developed from the gutter profile that is to be used. The two profiles will be noticeably different when held up next to each other. The layout of rake miters requires a simple 45 degree angle on the gutter, and a compound miter on the rake molding. Where the rake miter occurs at a typical gable end, (a 90 degree outside corner at a gable) the gutter is given a 45 degree outside miter. Where the rake miter occurs at a cross gable in the middle of a gutter run along a straight wall, the miter is reversed and the gutter has a 45 degree inside miter. In either case the compound angle on the rake crown is the same.

CONSTRUCTION SEQUENCE

In traditional carpentry, the rafter tails were first trimmed to give the desired amount of overhang at the eaves. The gutter was set in its proper alignment with the sloping roof plane and nailed in place. The gutter was allowed to run long at the gable ends--a few inches beyond the approximate point of intersection with the rake crown--to be trimmed later on. Next, the ***lookout blocks*** were installed under the gutter, and the frame for the ***gable return tables*** constructed. The ***plancier***, or ***soffit board***, was then nailed under the lookout blocks, and the lower fascia installed. The ***gable return tables*** were then capped with a ***washboard***. As the cornice construction progressed along the gable overhangs, the rake crown molding was held in position and the leading edge marked on the gutter. Using this mark, a 45 degree angle was cut on the gutter in place by eye using a hand saw. Next, the rake molding was returned to position next to this miter, and the compound cut on the rake molding was made by following the miter already on the gutter, again by eye using a handsaw. Then the remaining trim was installed, and the roof work begun. This practical method made it unnecessary to do a bench layout or compute the complex angles on the rake molding.

When the angles are to be machine cut, it will be necessary to do an accurate layout of the gable cornice to determine how far the tip of the rake crown will project from the wall when the cornice is built. This measurement determines the prepositioning of the miter on the end of the gutter. The cut on the rake crown molding is a compound miter that requires a compound miter box or slide saw capable of making very sharp edge miters in the range of 50 to 60 degrees.

OUTLET TUBES AND LEADER PIPES

Building codes have specific requirements for the size and placement of gutter outlets and leader

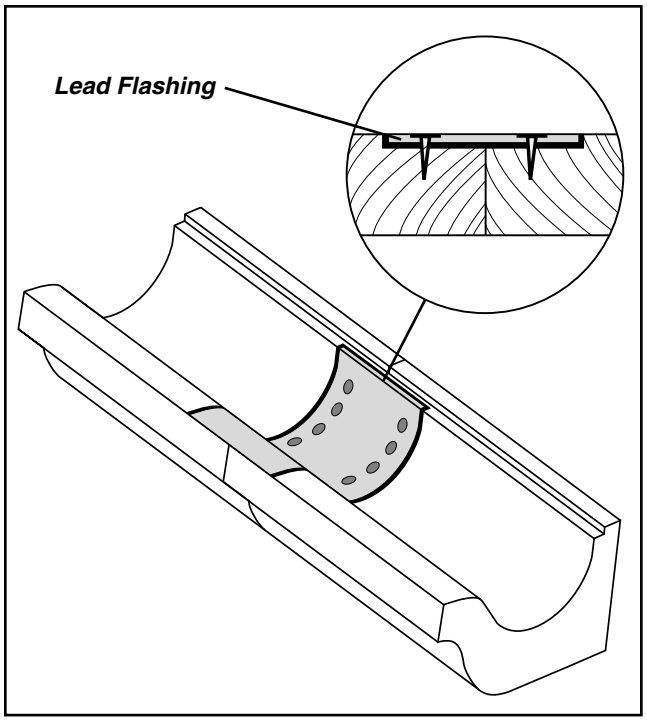

Figure 6: Gutter Joint Showing Traditional Lead Web Set in Asphalt Flashing Cement

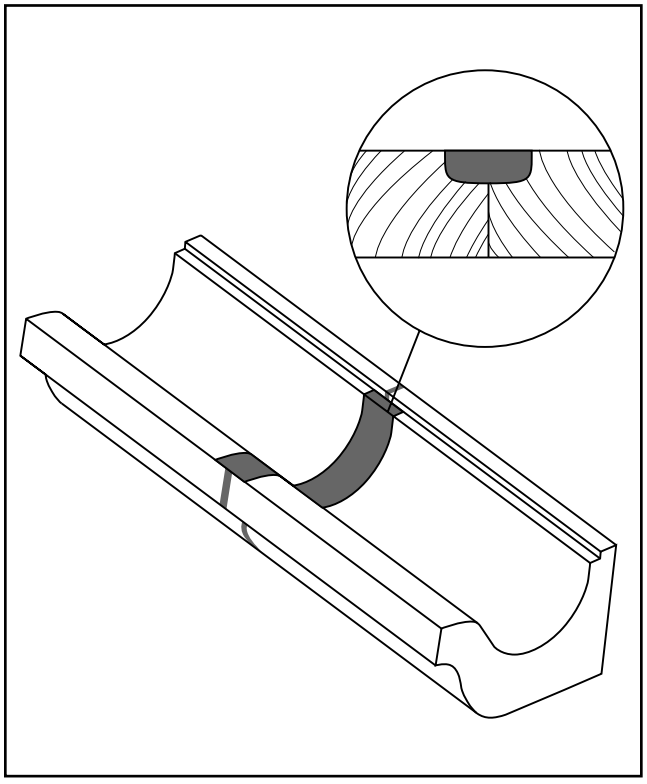

Figure 7: GutterJoint Detail Using Urethene Caulk Web

pipes. These computations are based on the volume of roof water to be collected on various segments of the roof. In typical residential construction, outlets are placed at approximately 25 foot intervals, and each isolated section of gutter requires at least one outlet. Outlet tubes in wood gutters are typically made of lead tubing onto which a flange has been formed. They are available in several diameters. The lead material is malleable enough to be easily formed to the curvature of the gutter trough by hammering. Because wood gutters should drain out between rains, the outlet tube flange must be mortised flush with the bottom of the trough and set in place with waterproofing mastic. The usual material is asphalt flashing cement, reinforced with copper tacks along the perimeter of the flange at abut ½" intervals.

The long term performance of asphalt mastic has never been entirely satisfactory, since the petroleum in the compound eventually dries out.

MAKING UP JOINTS

Gutter joints at the corners and in the middle of a run must be reinforced in addition to being made water tight. Traditionally, this was accomplished with a web of sheet lead, about an inch or two wide, mortised flush with the bottom of the trough, set in a bed of asphalt roof cement, and fastened with multiple copper tacks. *(Fig. 6)* In most cases where decay resistant gutters are used this joint, and the joints at the outlet tubes, have been shown to be the weak points in the installation, allowing water to seep in and begin the process of wood decay.

Modern polymer materials such as exterior adhesive polyurethane construction caulk may have significantly better performance characteristics compared to asphalt. However, these materials are subject to environmental degradation, particularly from solar radiation. As a result, thin applications of the materials should be avoided. Figure 6 shows a cut through the bottom of a gutter where a thick web of adhesive polyurethane caulk

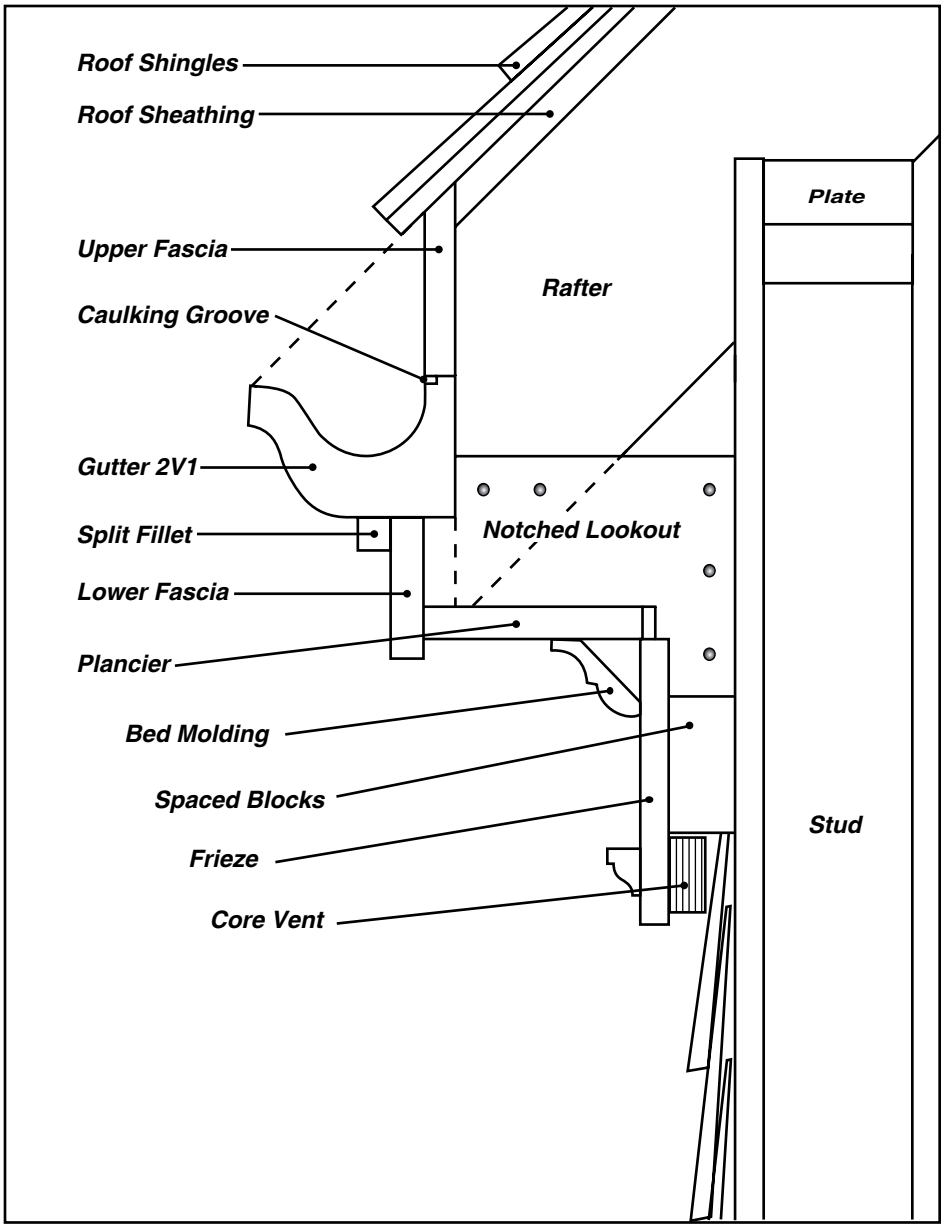

Figure 7: Suggested Detail Of Traditional Gutter Cornice Modified To Incorporate Continuous Eaves Vent Strip.

has been used to both waterproof and reinforce a joint. The mortise has been prepared with a small die grinder. Similar joints may be made up at the miters. The ends of gutters should be flashed with a ramp of lead flashing that carries up under the shingles.

Under no cases should gutter joints be made up by adhering mastic to the end grain of the joints only. The joint should always be reinforced with a connecting web as indicated above.

FASTENING GUTTERS

Wood gutters must be mechanically fastened at each rafter tail with one or two corrosion resistant nails. The fastening must be strong enough to resist normal mechanical stresses, including the placement of ladders, and the weight of winter icicles in cold climates. Fasteners should be extra long to compensate for the poor nailing of end wood. The best nailing for gutters is from the bottom at an upward angle using a long spike penetrating the rafters. (See Figure 6) When gutters are attached in this manner, the size of the spike should correspond with the size of the gutter: 20d spikes for 4x6" gutters; 30d spikes for 5x7" gutters; and 50d spikes for 6x8" gutters. If gutters are nailed inside the trough at the back, the nails heads should be sunk and covered with waterproofing mastic. Screws have poor holding power in end wood.

PRE-DRILLING GUTTERS

Western Red cedar gutters are highly prone to lengthwise splitting, and should be pre-drilled at all fasteners.

PERSONAL PROTECTION

Occupational exposure to Western Red cedar wood has been linked statistically to an increased

incidence of respiratory diseases, some of which are serious or life threatening. It is strongly recommended that suitable respiratory protection be used when working with cedar wood products, particularly when exposure occurs on a daily basis. So called “nuisance” dust masks do not provide adequate protection. Please consult a competent public health source for specific recommendations.