

## **Module 7 – Exposed Fastener Lap Seam Roofs**

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### **Chapter 1**

During this module, we will emphasize the importance of developing and following a fall protection plan as well as some vital rules for safety when installing an exposed fastener lap seam roof. You will learn how to ensure that your building is square and plumb, how to lay out a roof according to the manufacturer's requirements, how to handle roofing materials and stage them properly. You will learn the proper way to install NAIMA Certified insulation in the roof, and finally you will learn how to install an exposed fastener lap seam roof system correctly so that it will provide years of trouble-free service even in harsh climates.

Safety on the job site is never more important than during the roofing phase. Simply put, there is virtually no margin of error when your life and health and those of your co-workers is on the line. You and your crew members should be in a constant state of training and retraining when it comes to safety. The first step toward safety begins before you ever arrive at the job site. Your supervisor has the responsibility to develop and provide to you a comprehensive safety and fall protection plan that can be thoroughly reviewed by the entire crew. You see, if just one of your crew team members is not aware of the plan or is not committed to following it he will not only be a danger to himself but also to the entire crew. In addition to good training, it is vital that you have the proper safety equipment. This includes personal protective equipment required by OSHA as well as fall protection equipment that may be attached to the structure. It is also necessary that you have the right tools and lift equipment both for personnel and materials available on the job site. These will vary with each job.

Some rules that must be followed include: Stay alert constantly. The roof is no place for daydreaming on the job. Hard hats must be worn to prevent injury from falling objects or from equipment and materials being moved around personnel. Never step on light transmitting panels or translucent panels. They are not designed to support the weight of an installer or heavy tools or materials. Never step on an unsecured panel. Roof panels must be temporarily secured by c-clamps or securely attached to the purlins and eave struts before they can be a safe walking surface. Never step on a rib at the edge of a panel until the roof has been completely installed. Never step on a panel at the upslope end overhanging a purlin until the roof system has been completely installed. While a bundle of roof panels can be walked on safely an OSHA approved runway should be used for work platforms whenever possible. Be sure to wipe off any fluids that might be on the surface of the panels prior to walking on them. Rubber soled shoes will provide the best stability on the roof.

Finally, consider the current weather conditions as well as the forecast for your job site to be sure that precipitation or wind will not cause added safety hazards. All safety precautions referred to throughout this module required currently by OSHA as well as other statutory or customary practices must be followed carefully in order to maximize safety.

## **Chapter 2**

Before we begin the process of installing an exposed fastener lap seam roof, let's take a few minutes now to review some of the components on a typical metal building that may be mentioned in this module. First are the large vertical beams most commonly called columns. There are three types of columns: mainframe columns, which always stand along the side walls, end wall columns, and corner columns. On the very top of the columns at the intersection of the side wall and roof are eave struts.

Next are the rafters. They run across the building and are bolted to the columns. There are two types: mainframe rafters which run between the mainframe columns and the end wall rafters that are bolted between the corner columns and also bolted on top of the end wall columns. Attached to the rafters for roof support are purlins. There are terms used in roofing to describe various locations on or around the roof. First is the eave. This is the line along the sidewall formed by the intersection of the planes of the roof and the wall.

Next is the ridge. This is the horizontal line formed by opposing sloping sides of a roof running parallel with a building length. Next is the gable. This is the triangular portion of the end wall from the level of the eave to the ridge of the roof. The peak is the uppermost part of a gable. The rake is the intersection of the plane of the roof and the plane of the end wall. It should be noted here that an exposed fastener lap seam roof is also known in the industry as both an R-panel roof and a screw down roof. So regardless of which of these three names are used, it is the same roof system.

## **Chapter 3**

The next step in preparation for installing an exposed fastener lap seam roof is to confirm that the building is square and plumb. To do this you can use a transit or a laser to check for plumb columns and you can measure between rafters to ensure the building is square. If a building is out of plumb you can adjust the vertical steel cables or rods that crisscross between columns. If the building is out of square you can adjust the horizontal steel cables or rods that crisscross between mainframe rafters.

In order to produce this module on exposed fastener roofs, Butler Metal Building Manufacturing Company provided this training facility in Kansas City. This roof frame stands less than 6 feet off the deck. It will allow our video production crew to show you details that would be difficult to demonstrate for you on a standard roof due to safety considerations. During this module the erectors will be tied off properly to illustrate to you a more realistic scenario that you are most likely to encounter in a typical roof installation above 15 feet.

After confirming the building is square and plumb we need to review the building manufacturer's drawings and specifications carefully for this particular job. You are looking for the drawings and details that specify roof panel location, flashing and trim detail, mastics, sealants, and fastener types and locations. The integrity and performance of an exposed fastener lap seam roof system depends on following the manufacturer's instructions to the smallest detail.

All building materials used to construct a metal building are affected by changes in temperature which cause expansion and contraction. When metal is hot it expands. When it is cold it contracts. While all the building components are subject to these influences the roof is most affected. A metal roof will move three quarters of an inch every 100 ft per 100 degrees Fahrenheit. So in a climate that ranges from freezing to 110 degrees Fahrenheit you will see the

roof expand and contract up to an inch in 100 ft. As an exposed fastener lap seam roof system is installed, keep that in mind.

#### **Chapter 4**

In this chapter we will cover pre-drilling our roof panels for fastener location. The first step is to locate the roof panels, foam closures, mastics, sealants, and fasteners called for by the manufacturer in the storage area. Remember that with long panels you should have two installers pick up the panels from the sides as shown, not from the end. This will help prevent panel buckling.

Now stack the panels on dunnage to allow for pre-drilling. The installers have sorted the panels into two stacks, one for each side of the ridge. To align the panels you can take a piece of wood and strike it against the end of the panels as shown. Then measure and mark the side lap of the roof panels for stitch fastener location on intervals specified by the manufacturer. Now stack and clamp them together. A good tip to remember is to clamp the corners that will be covered when installed as to not leave a dimple visible on the finished roof. Then, using the specified drill bit, you can drill the panel holes for the stitch fasteners. Remember to only pre-drill the number of panels that you expect to install that day.

#### **Chapter 5**

In this chapter we will cover the process of laying out an exposed fastener lap seam roof. First we will show you one method used at another job site. Remember that there are several acceptable methods for doing this. Here, the installer's first step for installing an exposed fastener lap seam roof is to measure and mark the eave strut with a module mark for the first panel beginning at the rake.

Next the installer will mark the ridge purlins for panel modulation on both sides of the ridge. Now at the eave of the canopy overhang we will make the modulation marks as well. Then a chalk line is clamped at the canopy eave and stretched out to the ridge. It is aligned with the module mark at the ridge purlin and then snapped across the purlins between the ridge and the eave. Next a 100 foot tape measure is clamped to the purlin at the 3-foot mark aligned at the module chalk line as shown. Then the tape is stretched out along the purlin to the other rake wall and clamped. The purlin will then be marked on 3-foot intervals across the rest of the roof from rake wall to rake wall. This will establish panel modulation for all of the runs.

Now back at our training frame we will show you another method for panel layout. The installer will measure and mark for the first panel run at the eave. It is vital that you align the panel with these module marks exactly so the roof does not begin to creep a little with each run. This could cause you to be several inches off module at the far rake wall on even a small roof. The ridge purlin is then marked as well. The installer can now mark the other side of the ridge in the same way. First at the ridge purlin and then at the eave strut.

#### **Chapter 6**

Here we will demonstrate the process of staging your materials to the roof in a more common scenario on another job site. In most typical roof installations you would first place nylon straps around the roof bundle as shown to prevent panels from buckling. Then the first roll of NAIMA certified insulation is placed on the bundle of sheets along with the required mastics. Be sure you use material handling equipment that is suitable for your particular job. Here the load is carefully raised in position for best use. Never exceed the safe operating range of the equipment.

Here the signalman indicates movements needed to the fork operator for placement of the load on the roof. Be sure to allow enough space for the starter roll of insulation. Be very careful to ensure the load is sitting properly across the purlins and other structural components

prior to disconnecting a load. OSHA regulations require that the load be positioned no further than 8 feet from a rafter. Remember that the installer must always remain tied off until other adequate fall protection systems can be put in place.

## **Chapter 7**

Now back at our demonstration site, the panels will be aligned to make a temporary work surface from one eave to the other. Here the installers align the first sheet far enough over from the starting rake wall as to not interfere with the installation of the first run. They will measure and mark for alignment and temporary fasteners. A structural fastener is first installed at the eave. It is important to remember you are making holes in a panel and they should be holes that you will reuse later when the panel is relocated. Then a structural fastener is installed at the upslope end of the panel through the purlin. Now the installer can carefully step on the panel avoiding the ribs to install a second fastener. At the eve the installer will install a second fastener as well to the eave strut. Now at the other side of the ridge a panel is positioned and fastened in the same manner.

Finally, a section of ridge cap is positioned over the ridge as shown. The installer measures and marks for a fastener on both sides. Keep in mind that this piece of ridge cap will be relocated to its permanent location later. The holes you make for the temporary fasteners will need to be used for the permanent ones. So follow the manufacturer's specs carefully to determine the correct fastener location.

## **Chapter 8**

In this chapter we will look at the process for installing insulation in an exposed fastener lap seam roof. The first step is to locate the starter roll of insulation. Check the label closely to confirm that you have the one called for in the specs. Our next step is to install double stick tape as shown. This will temporarily hold the insulation in place until the rest of the roof components can be installed. Double stick is then installed on the other side of the ridge along the rake and at the eave as well. If there is any significant wind you will most likely need to apply double stick tape along the entire rake as well.

Now we are ready to position the first roll. This roll will often be identified on the label as the starter roll. The installers can now carefully unroll the fiberglass. Remember that insulation has no ability to support the weight of a worker, tools or equipment. Here the workers are aligning the first roll for installation. At the eave, the insulation is folded over and the tab on the double stick tape is removed as far as the first run of insulation will cover. The tab is removed from the tape at the other eave and the installers pull the fiberglass into place. Be careful not to overstretch the insulation as this would adversely affect the R value.

Now you can press down firmly, securing the face to the tape. Now the insulation is scored at the eave and the vapor retarder is folded over 6 to 12" to prevent wicking of water at the eave.

## **Chapter 9**

This manufacturer calls for installing a common eave flashing prior to installation of the roof panels. After the installer has located the specified eave flashing piece from the storage area, it is positioned at the eave as shown. Here the temporary structural fastener is removed from the downslope end of the work platform panel and reinstalled through the flashing and insulation. It may need to be removed in the following steps as to not interfere with the rest of the components yet to be installed. Be sure and measure to confirm alignment both at the eave and at the rake.

First the installers will measure and mark the eave flashing for mastic alignment. Now mastic is applied along the eave flashing as shown. Next the mastic tab is removed for the area

covered by the first panel run. This manufacturer calls for foam closures to be installed at the eave. The first one must be cut and aligned with the rake wall as shown.

Now the foam closure can be installed by pressing down securely on the mastic. These will provide an insulation barrier against the elements and also serve to keep the panels on module. The center of the high should align with the center marks made on the flashing.

Next a line of mastic is placed over the foam closures. Note that the flashing fastener heads are located behind the high of the closure where they will not interfere with the panel. Now the tab on the mastic can be removed. A good technique is to press down with your fingers ahead of the tab being removed to be sure it seals properly to the foam closure. Be sure the installer removes the tab from the double face tape along the rake and secures the insulation facing as shown.

## **Chapter 10**

In this chapter we will cover the process for installing the second and subsequent panel runs to the end of the roof. The next step is to apply a small piece of double stick tape to the purlins to secure the facing of the insulation. This is very important for maintaining a good lap seal when the next section of fiberglass is installed. The tabs can then be pulled and the facing secured. The installer will now locate the next roll of insulation and confirm that it is the correct one called for by examining the label. Now the roll is positioned at the eave and then it is unrolled. It is carefully placed over the purlins as shown. At the far eave, the installer has pulled the tab on the double stick tape and positions the fiberglass with the seams aligned, securing it to the eave strut. It is vital to align the seams tightly. Now the insulation is scored, being careful not to cut the facing. The excess insulation is then removed. Here the vapor retarder is folded over at least 6 to 12". This is done to prevent wicking of water at the eave. At the eaves the installers tuck the insulation under the eave flashing as shown. The tab on the lap adhesive is then removed. This will seal the two facings together. Another section of flashing is installed using temporary fasteners. At the eave another section of flashing is installed using temporary fasteners. After mastic is installed at the eave the tab can be removed. Then foam closures are installed, being careful to remain on your module marks.

Next, mastic is applied over the foam closures. Be sure to maintain the contour of the closure. Now the first panel in the second run is staged into position. The tab is now removed from the mastic on top of the leading edge rib of the first panel run from the eave to the ridge. Here the tab is removed from the mastic, covering the foam closures at the eave just far enough for the second panel to cover. Then a mastic pigtail is installed as shown at the eave. Now the panel is positioned aligned at the eave and tightly nested in the foam closure.

Next a stitch fastener should be installed in the first down slope pre-drilled hole in the panel side lap. The ridge cap will need to be pulled back as shown for proper alignment. Be sure to measure and check that your panel is on module. The installer measures from the rake back to the 3-foot mark centered at the panel rib. Now the rest of the stitch fasteners can be installed at the rib as shown. Be sure to hold your screw gun at a 15 degree angle toward the trailing edge in order to draw the lap in tight.

Next the structural fasteners can be installed at the eave. Then the structural fasteners at the intermediate purlins are installed on marks to maintain straight fastener lines. Here the second piece of ridge cap is positioned. It is aligned and the ridge cap is used as a template to mark the roof panels on both sides as shown. These lines will be used as a reference for locating the mastic under the ridge cap. Note that the holes made by the temporary fasteners will be used again for our permanent structural fastener.

Next measure and mark for the specified mastic line 1 inch up from the ridge cap lap line. At the leading edge of the ridge cap raise the edge and install mastic as shown. This has been repeated on the other side of the ridge. Now the tabs can be pulled from the mastic. A small piece of mastic is applied at the top of the trailing edge rib as shown. Look carefully at

how the two pieces of mastic are married together. Now mastic is applied along the entire leading edge of the first ridge cap section. Then the tab is removed from the mastic. Mastic is applied starting at the ridge and going down the side lap of the second panel run as shown. The mastic is then cut off at the eave. The tab is removed from the mastic from the eave to the ridge. Now the second section of ridge cap can be installed.

The installer places his knee over the ridge cap rib to be sure it is nested perfectly. Then the specified stitch fastener is installed at the rib. The rest of the stitch fasteners are installed in the ridge cap according to the manufacturer's specifications. Remember to install the structural fasteners at the leading edge of the first panel run. Next the second ridge cap section is measured and marked for fastener placement according to the manufacturer's specifications. Remember that this is important both for an adequate seal and professional appearance. Then the structural fasteners are also installed in the specified manner on both sides of the second ridge cap section.

## **Chapter 11**

In this chapter we will look at the steps for installing the first run of panels. Here one installer hands up the first panel for the first run to the other installer. The sheet is then positioned. You should measure to confirm alignment at the eave according to the particular manufacturer specifications. Here a small mark is made to align the panel at the eave. Now the sheet is positioned over the closure. Be sure that the top of the panel is aligned properly with module marks prior to pressing it down against the eave closure.

Next we will measure and mark the panel for fastener placement along the eave strut. The first fastener is installed at the trailing edge corner of the sheet next to the rake. Here you will see how the fastener will draw the panel down to nest tightly in the foam closure. The installer at the top of the panel can now measure and confirm proper alignment with the rake. The panel may need to be bumped in or out as shown. The installer then measures and marks the panel for the specified fastener locations at the purlins. Then a structural fastener can be installed at the top of the panel. Now at the eave the next fastener can be installed at the leading edge. Be sure to confirm the panel is on module. This is crucial. The rest of the fasteners can now be installed at the eave as specified by the manufacturer.

Here the installer at the upslope end of the panel is measuring to mark the panel for fastener location on the purlin in a straight line. Now the required fasteners can be installed. The purlins on this roof are designed to roll with the expansion and contraction of these panels due to temperature change. At the other side of the ridge, the panel for the first run can now be staged. Here the tab is then removed from the mastic on the eave closure. The installer then measures and marks the panel for alignment at the eave. The panel is then positioned, aligned with the foam closure and press down securely. Then the panel is marked along the eave for fastener locations.

Now a structural fastener is installed through the eave strut near the rake. At the upslope end of the panel the other installer uses a section of ridge cap to align the panel ribs on both sides of the ridge prior to installing the purlin fastener. The ridge cap is centered by measuring the laps on both sides of the ridge as shown. Small marks are made along the bottom edge to align the ridge cap. At the same time the other fasteners can be installed at the eave beginning at the leading edge. At this point the intermediate fasteners can be installed along the purlins.

Notice how the installer can feel through the insulation to confirm the location of the purlin for fastener placement. The installer is eyeballing these rather than measuring and marking the panel. As you can see here, simply eyeballing the fastener does not leave a good straight professional appearance. After all of the structural fasteners have been installed in the first run on both sides of the ridge we can apply mastic from eave to ridge along the leading edge rib as shown. This will be done on both sides of the ridge. Remember mastic should always be cut with a utility knife or scissors but never torn.

Now at the eave the installer pulls back about 6 in of the mastic tab. Here a short mastic pigtail is installed as shown. This will help to keep water from being blown up under the panel laps at the eave. Now up at the ridge the installers can measure up the distance specified by the manufacturer to place a series of marks for mastic alignment. In this case that is one inch above the lower edge of the ridge cap where our red marks were made earlier. The installer then pulls back the first 6 in of the mastic tab on both sides of the ridge. Now the mastic is applied along the marks. Then the tabs are removed from the mastic on both sides of the ridge. The first ridge cap section is now positioned aligned with the red marks as shown and pressed down securely against the mastic.

Now we will measure and mark the ridge cap for fastener location according to the manufacturer's specifications. In this case that is 2 in up from the bottom of the ridge cap. Now the installer can place his knee on the rib as shown to be certain that the ridge cap is nested properly against the panel. Then a structural fastener can be installed. Now the rest of the structural fasteners can be installed in the ridge cap. We will install the fasteners at the leading edge in the next chapter.

As you can see here the ridge cap should align perfectly with the major and minor panel ribs. Now it is safe for us to remove the ridge cap and panels we have been using as a temporary work surface for the installers. All the fasteners are removed. Then the panels are repositioned over the first panel run.

## **Chapter 12**

In this chapter we will look at the procedures for installing a panel endlap seal. You will need to do this whenever a single panel is not long enough to run all the way from the eave to the ridge. Every manufacturer calls for a specific alignment, mastic detail, and fastener types and locations.

The first step is to install the required mastic on the leading edge of the short panel from the upslope end to the eave. Here the installer is wiping off the roof panel to remove some fluid that could cause him to slip. Now the installer can mark the upslope end of the panel for the lap at 6 in for panel line and 5 in for a mastic line as specified by the manufacturer. Here the rib is marked at the trailing edge 6 in down for mastic placement. Then a 6-inch piece of mastic is installed at the trailing edge as shown. Next mastic is installed across the panel on the 5-inch mark as shown. Now the mastic tab is pulled.

Here the next panel is positioned. It is aligned at the 6-inch lap marks. Be sure the upslope installer aligns his end of the panel as well. It is then pressed down to nest perfectly. Next measure and mark for the correct fastener placement. Notice how the installer applies pressure with his knee on the corrugation before installing the structural fastener. Finally the stitch fasteners are installed in the upslope panel. That completes the specified endlap seal detail.

## **Chapter 13**

In this chapter we will cover the final steps for completing the exposed fastener lap seam roof installation. Using a fine bristle push broom, sweep off the areas of the roof that were worked on that day to avoid rust and damage to the panels. Be careful as you do to be considerate of those working below to assure that they are not injured by encountering falling debris.

As you are cleaning up, carefully inspect the roof to be sure that all of the fasteners have been installed correctly, that the neoprene washers are properly seated and the mastics are compressed correctly. If a neoprene washer blows out around a fastener while you were installing it remove it and replace it with another fastener. This is critical to maintain a waterproof barrier. If a structural fastener is stripped replace it with the next size fastener. If a stitch fastener strips out you will need to do the same. In rare cases you may encounter a situation

that requires a special washer with a rubber seal on one side to be installed to cover a problem like this. You should first apply a piece of mastic. Then attach the washer with a larger fastener as shown. After the roof has been completely cleaned and inspected you can now remove the fall protection systems in the proper manner according to OSHA regulations.

This concludes the module on Exposed Fastener Lap Seam Roofs. This presentation was created by the Metal Buildings Institute and is one of several training modules available to metal building erectors. We hope that it has helped you in understanding the basics of exposed fastener lap seam roofs.