

Authorized Trainers Guide















Torch-applied Roof System Safety CERTA Program



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CERTA Program Torch-applied Roof System Safety

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PROGRAM POLICIES AND PROCEDURES

Program Introduction

Thank you for making the effort to be a CERTA authorized trainer.

CERTA has changed the way workers use torches. Roofing workers today are using torches more carefully than in the past. The decisions they make and actions they take while using roofing torches contributes to the safe and successful application of torch-applied roof systems. Your commitment to being a trainer is improving the safety and image of the entire roofing industry.

This CERTA Authorized Trainers Guide provides specific instructions to prepare for and facilitate successful CERTA training sessions to certify torch users. These instructions represent minimum activities and time allotments for conducting CERTA training classes. The appendix to this guide provides updated language in The NRCA Roofing Manual as well as pages from the manual.

NRCA provides complete facilitation guides for certification and recertification classes. They contain speaking notes, instructions for learning activities and questions designed to prompt participants' learning. You are encouraged to modify these instructions to change time allotments and create your own training activities to meet the needs of the workers you train.

In 1986, the MRCA, in conjunction with the Asphalt Roofing Manufacturers Association and the United Union of Roofers, Waterproofers and Allied Workers, developed a curriculum for training roofing workers in the safe application or torch-applied roof systems. This program was named the CERTA program.

In 2003, the insurance industry approached NRCA to address concerns about increasing incidents and losses occurring during torching activities by roofing contractors. NRCA recognized two things: Torching activities were, and will continue to be, a part of the roofing industry; and roofing workers traditionally have learned many skills, including torch use, through on-the-job techniques. This training method was not adequately addressing the safety concerns, and the need for focused training for safe torch use became apparent. NRCA adopted and revised the CERTA program to meet this need.

The CERTA program provides safety practices and industry requirements for torching activities. The program includes classroom instruction, student manual, video and hands-on training. There is no comparable safety training program available in the roofing industry. CERTA-authorized trainers must teach or preside over every CERTA class.

The program addresses concerns of roofing contractors, the insurance industry, fire and code authorities, roofing material manufacturers, equipment manufacturers and fuel suppliers. Upon successful completion of the classes you will teach, participants will be certified roofing torch applicators. CERTA identification cards will be issued to those who become certified, and a list of certified applicators will be maintained in the NRCA database. This certification is valid for three years though it may be rescinded at any time if a certified worker is observed performing unsafe work practices.



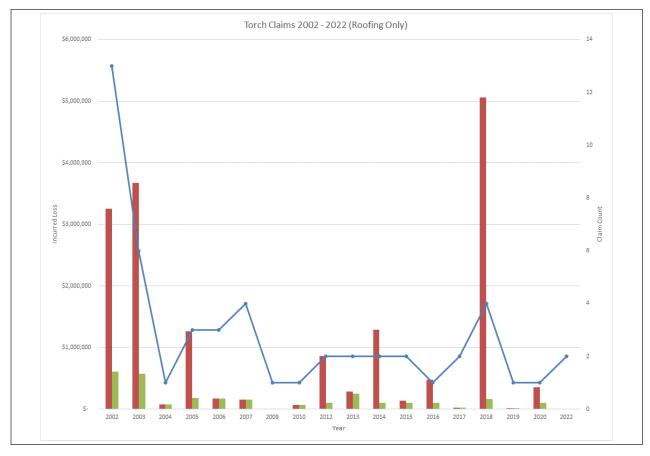


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Program Success

Roofing torch-related fire incidents have decreased significantly since 2002 when the CERTA program was implemented. The following data regarding losses paid for fire damage caused by improper use of a roofing torch was shared by CNA, a major U.S. insurance underwriter that offers general liability coverage to roofing contractors.



The CERTA program has had a significant impact on the number of torch-related incidents, yet claims can be extremely costly as seen in 2018 when two serious fires resulted in massive payouts. In 2017, FM Global recommended the use of CERTA applicators on FM-insured buildings.

Key Learning Objectives

Upon successful completion of CERTA certification training, participants will be able to:

- List personal protective equipment requirements for torching activities
- Describe basic first-aid procedures associated with torching injuries
- Describe the PASS system for using a fire extingusher
- Identify the key elements of a comprehensive pre-job inspection
- Prescribe hazard controls when torching near hazardous areas
- Name the components of a roofing torch assembly
- Explain proper steps and procedures for handling propane gas cylinders
- Recognize hazardous areas for torching
- Describe safe torching techniques to use near hazardous areas
- Explain the post-job fire watch and other duties
- Demonstrate all skills listed in the Certification Teaching Notes

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Upon completing the CERTA recertification training, participants will be able to*:

- Explain the purpose of each published safety practice
- Identify the safety practice that best applies to given situations
- Identify common fire hazards encountered during torch-applied installations
- Prescribe application methods that reduce fire risks when torching near hazardous areas
- Demonstrate all skills listed in the Recertification Teaching Notes

*It is expected that recertified participants will be able to accomplish all of the objectives listed for the certification class as well as those specified for the recertification class. By definition, course objectives should determine class content and be measureable. Because the recertification class is shorter than the certification class, it is not reasonable to specify the same number of specific objectives.

Trainer Resources

Authorized Trainer Database

NRCA's CERTA program administrator maintains a secure database of all current and past authorized CERTA trainers. It is the responsibility of authorized trainers to update their contact information via their trainer portal.

Individuals, groups or organizations interested in receiving certification training may find your contact information on the NRCA website. You are not obliged to respond or conduct additional training. This is a service to the roofing industry not to any one company or trainer.

Website

NRCA maintains a website for authorized CERTA trainers. The website allows trainers to download program materials, including student manuals, authorized trainers guide, administrative tools and other resources designed to assist with training efforts. The only documents not available on the website are student final exams and answer keys. Exams and answer keys will be uploaded to the trainer portal when trainers register training sessions and they have been approved by the CERTA program administrator. The website is nrca.net/education/certa/trainer-resources.

Program Update

Occasionally, the CERTA program administrator will contact authorized trainers to communicate program updates.

Training Session Requirements

Training Session Size

The maximum number of participants for a single eight-hour CERTA session facilitated by one instructor is 20. One authorized instructor cannot safely observe more than 20 participants during a hands-on training session. A session size may be increased provided additional authorized instructors assist with the hands-on training section of the program. The ratio of instructors to participants for the hands-on section must remain 1:20.

Training Session Duration

Certification

Conducting a CERTA certification session requires a minimum of five hours of classroom instruction plus a minimum of three hours of hands-on training for a full class of 20. Smaller class sizes may or may not reduce these times. All material must be fully addressed regardless of class size. Detailed schedules, including times, can be found in each section of the trainers' notes.

Recertification

A CERTA recertification session must comprise a minimum of two hours of classroom instruction and two hours of hands-on activity for a class of 20.

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Mixed (certification and recertification) class

When teaching a class in which there are participants being certified and recertified, the full eight-hour class is recommended for everyone though you are permitted to be creative as long as you meet the minimums and achieve the objectives. First-time participants may not be certified in a half-day recertification class.

Training Session Registration

You must register each session at least three days in advance via your CERTA trainer portal. Trainers can access their portal by logging in to NRCA's website using their email as their username.

After trainers register sessions, the CERTA program administrator will issue training session numbers via email. Emails will include the link to the trainer resources web page where class documentation can be accessed.

After a class has been approved, the exam and answer key will be available in the trainer's portal. If the class date changes or the session is canceled, the trainer must notify the CERTA program administrator at CERTAadmin@nrca.net.

Trainers should NOT proceed with training unless they have a session number from NRCA. <u>Training conducted without being registered WILL NOT be recognized.</u>

Training Session Quality Control

The success of any training program depends on the quality of instruction. CERTA training can significantly affect roofing worker safety and reduce property damage. As an authorized CERTA trainer, your job is to provide effective instruction that meets this goal.

This guide is designed to help you establish consistent, high-quality CERTA program instruction. Following the guide will help ensure your training efforts successfully meet the program objectives.

You are expected to make every effort to maintain high-quality instruction. To that end, by accepting your role as an authorized CERTA instructor, you agree to allow CERTA program representatives to randomly select and attend your training session for quality control purposes.

Training Compliance

If at any time during your tenure as a trainer you fail to comply with the policies and procedures set forth in this trainers guide or behave inappropriately in your role as a trainer, the CERTA program may take the following actions:

- Revoke your authorized status
- · Revoke the certifications of all individuals you have trained

You, individuals you have certified and their employers will immediately be notified of these actions.

Certification Procedures

There are a few tasks you will need to complete after each training session to ensure trainees get certified or maintain existing certifications. These tasks include:

- Completing a session roster, via your trainer portal, within five business days
- Processing the payment, via your trainer portal, within five business days of receipt of the invoice.

Roofing workers will not be certified until completed rosters are received and payments are made. This process could take a minimum of two weeks.

Certification Requirements

Participating in a CERTA training session does not guarantee participants become certified roofing torch applicators. There are two program requirements that must be satisfied before participants can be approved for certification:

- 1. A 70% or higher score on the exam
- 2. Passing evaluations on a peer-rated performance evaluation for the hands-on portion of the class

You also should deny certification of participants who behave in ways that are contradictory to program objectives. Examples would be: Unruly or disruptive behavior during the session or causing injury to oneself or another participant whether intentional or not.

Certification and Recertification Fees

Certification	Recertification
\$210	\$170

Fees are the responsibility of the trainees' employer. After completing a training session, an authorized trainer is responsible for entering the roster, via their trainer portal, within five business days of the class and processing the payment within five business days of receiving the invoice.

Authorized trainers may charge and collect a separate fee for providing their training services but may not collect payment from employers for trainees' certification fees.

Training Session Roster Report

Trainers must enter a training session roster via their trainer portal and should refrain from using all caps.

Necessary information includes the following:

- First name, middle initial and last name
- Home mailing address
- Home telephone number
- Personal email address
- Current employer (company name)
- Final exam grade
- Hands-on performance pass/fail status
- Previous Employer

CERTA Identification Cards

CERTA ID cards will be uploaded to the trainer's portal as soon as the invoice has been paid. The trainer is responsible for distributing the ID cards to the participants.

Participants do not need to wait for their CERTA cards to start work as certified applicators; however, they are only certified after:

- Successful completion of all training program requirements
- NRCA has received the session roster
- NRCA has received full payment of fees

Authorized trainers can contact the CERTA program administrator to determine whether all requirements have been fulfilled.

Recertification of Applicators

Torch applicator certification is valid for three years. Written notices will be mailed to the company approximately six months before their expiration dates, providing recertification requirements and procedures. It is the responsibility of the applicator to inform the CERTA administrator of contact information changes.

It is the responsibility of the CERTA trainers to make certain those who attend their applicator recertification classes have previously attended a class and have not let their applicator card expire.

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Reauthorization of Trainers

Authorized trainer status also is three years. Notices will be emailed approximately six months before authorized trainers' expiration dates, to the address on file. It is the responsibility of trainers to inform the CERTA administrator when contact information changes.

Conducting Final Exams

The exam provides an evaluation of participants' knowledge, an opportunity to revisit content from the class, and sheds light on how well trainers led the classes. Effective training is measured by outcomes. For instance, if most people answer a particular question incorrectly, a good trainer will question whether he or she addressed the point adequately.

Most participants will be able to complete the final exam in a written format at the end of the training session; however, some participants may have learning disabilities, comprehension or reading problems, language difficulties or test anxiety. Help participants by discussing these kinds of issues during the day and letting them know there are alternatives to taking the exam at the end of the class. Encourage people to approach you during breaks to discuss options, such as taking the exam orally at another time.

The CERTA exam consists of multiple-choice and true/false questions and is open book, meaning participants can use their note-books, notes they have written and any information posted on the walls or boards. Explain they are to choose the best answer. Periodically, there may seem to be more than one correct answer, but there is only one best answer. They should know, but tell them cheating is an automatic failure.

Distribute the exams, and let them work. Do not allow discussion. If anyone asks a question, answer, but do not elaborate on anything that would give away the answer unless you realize you didn't address a topic in which case you should explain the point even if you end up providing the answer. As they finish, collect the exams and put them away so others can't see them.

Conducting an Oral Exam

It is recommended to schedule oral exams within 24 hours of the training session.

There are a few ways to do an oral exam. If it's for just one person, you can ask the questions, provide the options, and circle the answer he or she gives. If you have more than one person in the session, you should use a flip chart or white board to write an example of the questions' formats, whether multiple choice or true/false. Show them, if necessary that the top answer is A, then B, C and so on. Point out each letter symbol so they see the sequence and will be able to recognize it on their exam papers. Read each question, followed by the answer options. State the letters as you read the answers, specifying the order on the paper. Repeat the questions and answers as many times as necessary, but do not elaborate.

Grading

Written exams

The certification exams have 25 questions. Each question is worth four points. Total the number of incorrect answers, and multiply by four. Subtract this number from 100 to calculate the score. Report the scores on the session roster. Recertification exams contain 20 questions, so each one is worth five points.

Hands-on Exercises

The hands-on evaluation for this course is pass/fail by peer evaluation. Participants evaluate each other using the 60-item evaluation form. Trainers will collect the forms and report participants' scores as "P" or "F." Criteria for scoring are found in the teaching notes (Certification: page 24, Section C13; Recertification: page 15, Section C12).

Retesting

A trainee will not be certified if he or she fails either the written exam or the hands-on performance evaluation.

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Copyright Permission

Authorized CERTA trainers are granted permission to copy any part of the CERTA program materials, including student manual, authorized trainers guide, teaching aids and administrative documents, for the sole purpose of performing their duties as authorized CERTA trainers. Commercial copy service companies may require written permission from the copyright holder to produce copies. A permission form signed by a CERTA program administrator can be downloaded from the trainer website. CERTA program materials may not be modified in any way.

Conclusion

If you have any questions about CERTA, feel free to contact the CERTA administrator.

NRCA CERTA Program Administration 10255 W. Higgins Road, Suite 600 Rosemont, IL 60018-5607

Email: CERTAadmin@nrca.net Telephone: (800) 323-9545

Thank you for your efforts at helping to make torch-applied roofing work safer for everyone.

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MATERIALS, SETUP AND SCHEDULES

Materials

Certification Classroom Training Materials

CERTA program Authorized Trainers Guide

Student manuals – one copy for each participant (reminder—20:1 ratio)

Be prepared to show the CERTA video, and have a monitor, screen or wall large enough for everyone to see it.

Flip chart, dry-erase board or chalkboard with markers or chalk

Propane roofing detail torch (105 btu or less) assembly, including:

- Assembled torch
- · Hose and connectors
- Pressure regulator
- POL connector
- Propane tank (10- or 20-pound size)

Roofing materials, including two small samples pieces of each of the following:

- Wood fiberboard roof insulation
- Polyisocyanurate insulation
- DensDeck® gypsum board
- Wood fiber cant strip
- SBS polymer-modified bitumen membrane
- APP polymer-modified bitumen membrane
- Heavy glass base sheet
- Type IV glass ply sheet
- Self-adhering, smooth-surfaced polymer-modified bitumen base sheet

Optional Classroom Materials

1-inch three-ring binder for each student manual

Name tent card or nametag for each attendee

Recertification Classroom Training Materials

CERTA program Authorized Trainers Guide

Student manual photocopy for each participant

Flip chart, dry-erase board or chalkboard with markers or chalk

Optional Classroom Training Materials

1-inch three-ring binder for each student manual

Name tent card or nametag for each participant

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Hands-on Training Mockup Materials—Certification and Recertification		
Quantity	Unit	Materials
192	Sq. ft.	1/4-inch fiberglass mat-faced gypsum core panel
3	sheets	4-foot by 8-foot by ½-inch CDX plywood
15	Each	2 x 4 dimensional lumber, 45-inch length
6	Each	2 x 4 dimensional lumber, 8-foot length
2	Each	2- by 12- or 14-inch construction-grade dimensional lumber, 12-foot length
150	Each	1 ¹ / ₄ -inch general-purpose screws
100	Each	16-penny nails
50	Each	34-inch tin-capped roofing nails
2	Each	9-inch metal pie tins, large coffee cans or galvanized tall cone flashings
2	Each	4-inch diameter steel pipe, 10- or 12-inch length
2	Each	½-inch plywood circles cut to 4-inch O.D. pipe size
2	Each	12-inch wood screws

Hands-on Training Materials		
Quantity	Unit	Roofing Materials, per 20 participants
1	Roll	Heavy fiberglass base sheet (#75-type)
1	Roll	Self-adhering polymer-modified base sheet
9	Rolls	APP polymer-modified bitumen membrane—smooth or granulated
8	Each	Wood fiber cant strips—3-foot lengths (optional)
1	Box	Arrow T-50 staples for staple gun (or equivalent)
10	Each	Hooked blades for roofing knives
1	Bottle	Liquid soap (for leak detection)



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Hands-on Training Roofing Equipment		
Quantity	Unit	Roofing Equipment per 20 Participants
4	Each	20-pound vapor liquid petroleum gas cylinders
4	Each	Pressure regulators
4	Each	Pressure gauges
4	Each	25-foot UL-listed hoses
4	Sets	Swivel-type connectors for torch assemblies
2	Each	Propane roofing torches—detail application size not to exceed 105K Btu
2	Each	Propane roofing torches—field application size
4	Each	Spark-type igniters
2	Each	Adjustable wrenches
1	Each	Flat-blade screwdriver (for changing knife blades)
4	Each	Utility-type roofing knives
1	Each	Arrow T-50 staple gun (or equivalent)
4	Each	Large round-nosed trowles
2	Each	4A60BC fire extinguishers, fully charged, with updated inspection tags and intact plastic seals
1	Each	Comprehensive first-aid kit
1	Each	Clean plastic 5-gallon pail (for water)
1	Each	Small plastic squirt bottle
5 – 20	Each	ANSI ZX-97 goggles (eye protection)
5 – 20	Pair	Leather-palmed heavy work gloves (hand protection)

Setup

Classroom

Participants' abilities to learn are somewhat tied to their physical comfort. Discomfort is a distraction and will take away from a trainer's ability to reach his or her objectives. To that end, make every effort to minimize environmental distractions.

Provide writing surfaces and comfortable chairs. Make sure to have a flip chart, dry-erase board or a chalkboard, as well as markers or chalk. A television monitor or projector screen should be large enough for everyone to be able to see details in the video. The room should be well-lit, relatively quiet, free from distractions and kept at a moderately comfortable temperature. Washrooms should be accessible.

Hands-on Area

When setting up the hands-on activity, make sure the space is large and open enough to accommodate mockups, propane and lit torches. Most important, it must be big enough for all class participants to engage in torching activities and be able to see and maintain safe distance from one another and lit torches.

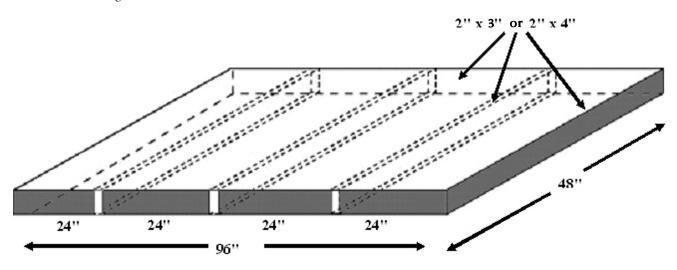


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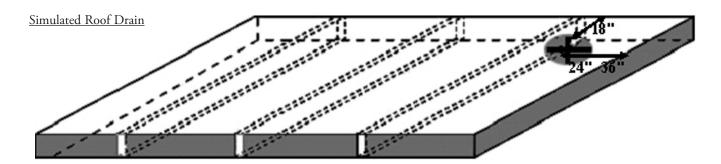
Mockup Design, Construction and Setup

The drawings below represent mockups to construct before conducting the hands-on training portion of this program.

Basic Flat Deck Design



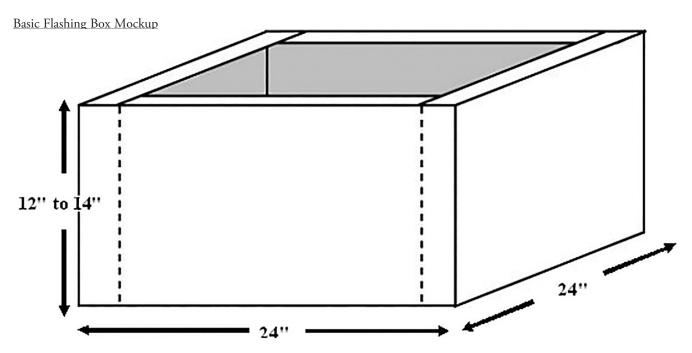
Construct a basic flat deck using 2 x 3 or 2 x 4 dimensional lumber secured with 16-penny nails as shown above. Install one layer ½-inch minimum CDX plywood to deck over the 2 x 4 frame, secured 8 inches on center with 1¼-inch general purpose screws. Install two layers of ¼-inch fiberglass mat-faced gypsum core panel secured with ¾-inch tin capped nails over the plywood. You will need to construct three basic flat deck mockups to conduct the hands-on training exercise.



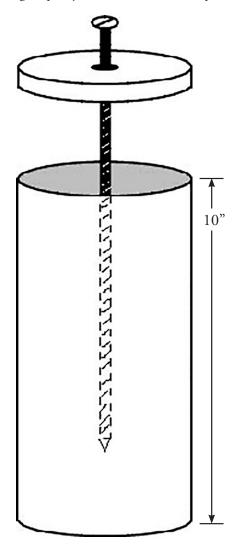


Cut a hole 18 inches from one side and 18 to 24 inches from one end in two of the three basic flat deck mockups. Use a 9-inch metal pie tin, large coffee can or an inverted galvanized steel "tall cone" flashing cut to height to simulate a roof drain opening. Secure the simulated roof drain in the hole.

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Construct a basic flashing box mockup using four pieces of 2- by 12-inch or 2- by 14-inch dimensional lumber nailed together using 16-penny nails. Add new cant strips for each training session.





Basic Pipe Penetration Mockup

Construct a basic pipe penetration mockup using a minimum 10-inch length of 3- or 4-inch pipe, a circular plywood disk cut to size of the outer pipe diameter and a screw 2 inches longer than the pipe length. Drill a hole near the center of the plywood disk to accept the screw. Secure the basic pipe penetration mockup at the opposite end of the basic deck mockup approximately 18 inches from one side and 24 inches from the end. The basic pipe mockup can easily be removed for storage.

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Mockup Station Layout Plan Propane cylinders set 10 feet minimum from mock-ups Station 4 Roof drain Station 3 Pipe penetration 3 Basic deck mock-ups Fire extinguishers (F Heavy fiberglass base plies for protection Flashing box Flashing box Station 1 Station 2

Lay the three deck mockups side by side with the two drain openings at opposite ends. Cover the entire deck mockup layout with a heavy fiberglass base ply sheet stapled into place. Lay fiberglass base ply ground protection for stations 1 and 2 at the flashing box areas. Set flashing boxes approximately 8 to 10 feet apart. Install cant strips around flashing boxes. Cover flashing boxes and cant strips with heavy fiberglass base ply sheets stapled securely in place. Set two 20-pound fire extinguishers between the work stations. Set a 20-pound propane tank a minimum 10 feet away from each workstation.

Schedules

Note: Breaks and lunch are not included in these schedules, but they are essential. Monitor the needs of your group, and give breaks accordingly.

Certification Schedule		
Event	Time	
Program Introduction	35 minutes	
Section 1: General Requirements	30 minutes	
Section 2: Pre-job Planning and Preparation	30 minutes	
Section 3: Propane Tool and Equipment Safety	45 minutes	
Section 4: Application Safety	90 minutes	
Section 5: Post-job Requirements and Duties	30 minutes	
Hands-on Training	180 minutes (3 hours)	
Final Exam and Review	40 minutes	
Total	480 minutes (8 hours)	

Recertification Schedule			
Event	Time		
Program Introduction	30 minutes		
Section 1: Safety Practices for Torch-applied Roof System Application	30 minutes		
Section 2: Hazard Identification	60 minutes		
Hands-on Training	120 minutes (2 hours)		
Final Exam and Review	30 minutes		
Total	270 minutes (4.5 hours)		

The hands-on exercises are three hours and two hours, respectively, for the certification and recertification classes. Detailed schedules can be found in the Certification and Recertification Teaching Notes.







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TRAINING BEST PRACTICES

Preparation

Effective facilitation depends on preparation, which is perhaps the single most important responsibility of your job as a trainer. Preparation time includes practicing your presentation. Study these course materials, and review all parts of the teaching notes and student manual. Practice presenting some of the topics in front of your family or co-workers, and ask for feedback. Good facilitation skills are acquired over time and do not happen naturally for most people.

The hands-on portion of this program also requires extensive preparation. Mockups should be constructed and base plies installed. Roof membranes should be pre-cut and placed next to each work station. You want participants to spend their time practicing torching skills, not cutting and fastening skills.

Adult Learning

Helping adults acquire new skills and knowledge can be exhilarating and challenging. It takes patience, flexibility, creativity and a strong conviction that what you are doing matters. The goal of training is to affect behavior, not just transmit information.

Training should be learner-centered and performance-based. Research suggests skill improvement takes place when participants are involved in practical, hands-on exercises that are realistic and challenging. Ideally, it's fun, too! Here is a summary of some things known about adult learners:

- Results—Worker training should be a means to an end. Let them know what's in it for them!
- Real-life application—Training should solve real-life problems rather than being entirely academic.
- · Action—Adults are accustomed to participation, so create situations that welcome their contributions.
- Experience—Workers bring considerable experience into any new situation. Give them the opportunity to contribute.
- Self-esteem—Adults have a need to maintain their self-esteem; do not embarrass them.
- Social interaction—Adults learn best by interacting with instructors and other participants in classes.

Your Role as Facilitator

As trainers, it's ideal to think in terms of being facilitators. Facilitators, by definition, facilitate. Primarily, this means encouraging interactivity. The goal is to provide an environment where interactions stimulate participants to acquire new skills, knowledge and attitudes to achieve the course objectives.

Some ways to establish a learning environment are the following:

- Explain outcomes and how they can best be achieved by working together.
- Encourage questions, and give participants permission to answer each other's questions.
- Demonstrate an open and nonjudgmental attitude.

Training Methods

This section provides guidelines and examples for using various training methods in the classroom portion of any training experience.

Interactive lectures

Lectures are not typically the best method for training because, statistically, people don't remember as much as when they are involved in discussion and activity. However, there are times when a lecture format is OK.

- Lectures are a contrast to other training techniques.
- They are an efficient way to present content and can be effective if they are followed by activities that reinforce the information.
- They allow some participants to ask questions and share experiences with the whole group.

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Process: Make lectures interesting:

- Personalize content with stories.
- Repeat core messages in different ways.
- Encourage questions.
- · Ask participants to share their experiences related to the topic.

Small groups

Small group work builds camaraderie among participants and enables them to develop a shared understanding of new material. It also gives an opportunity to talk for those who are reluctant to speak up in the large group.

Groups should be limited to five or fewer. Groups can be formed by various means, but the more direction you provide the better.

Process: Tell participants the purpose of the group work and how much time they have to complete it. If necessary, specify that groups appoint spokespersons, scribes or other roles. Circulate among the groups to ensure everyone understands the goals and they are staying on task.

Pairs work

Participants pair off to discuss a topic or do a role play with one other person. This allows one-on-one communication and forces the quietest group members to be involved.

Process: After pairs have discussed a question or complete an assignment, ask a few pairs to share their thoughts or experiences with the whole group. Be careful because time can quickly pass when too many pairs want to share.

Games

Instructional games provide an appealing learning environment. This is a motivating approach that requires learners to demonstrate mastery of content. The CERTA program notes provide ideas for team and individual games.

Process: Games always have rules. Be absolutely clear about game rules before trying to explain them to a group because the whole experience will fall apart if you are unable to explain well what participants are supposed to do or if you cannot answer questions. Try to anticipate "what if" questions and have prepared answers. Small prizes can be fun but are not necessary.

Questioning

A core skill instructors can use to increase participation is questioning. Questions promote thinking and dialogue among group members. They also keep the trainer from doing too much talking!

One of the keys to good questioning skills is being comfortable enough with silence to allow discussion to begin. Sometimes, it may take a while before anyone will say anything. It can feel awkward, and even a relatively short period of time can feel like an eternity; however, it's unusual for silence to last too long before someone in the class speaks, so give it time. If no one speaks up, rephrase the question or back up and ask a simpler question.

Characteristics of good questions

- Concise
- Contains only one idea
- Thought provoking
- · Addresses important and relevant material
- Uses language common to the learners
- Open-ended, requiring more than a yes or no answer
- Relies on reasoning more than memory
- Challenging but answerable

Four types of questions

Direct questions—to a specific learner

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Instructor: Joe, you mentioned earlier you have experience with a roofing torch. Do you know how hot the open flame of a propane torch can be?

• Overhead questions—to learners in general; anyone can answer

Instructor: The open flame of a roofing torch is extremely hot; does anyone know how hot this flame can be?

 Relay questions—a learner asks the instructor, who then directs it to the class as a whole or even one specific person in the class

Learner to instructor: The torch flame must be pretty hot to make the bitumen flow like that. How hot does it really get?

Instructor: That's a great question, Jim. Joe mentioned he has experience with roofing torches. Joe, do you know the answer?

• Reverse questions—a learner asks the instructor a question and the instructor returns it to the same learner

Learner: I've used a roofing torch a lot, and I've seen it do a lot of damage. I was just wondering if you know how hot the flame really is.

Instructor: Good question; what would you guess?

Best practices for Q&A

- When someone asks a question, take a step toward them and seem eager for the question.
- · Check to be sure everyone heard the question. If they didn't, look to the asker to repeat it before providing an answer.
- Answer briefly, and stick to what was asked.
- Tie answers to the key points of lessons whenever possible.
- If you don't know the answer, and no one else in the room does, either, admit it. Find the answer, and get back to the student.
- · If someone asks a question to be provoking, answer politely and directly. Do not become defensive or argumentative.
- Create a "parking lot" to write questions that don't necessarily fit within the current conversation. "Park" the question, and revisit it later or during a break.
- If someone asks a question addressing an issue that will be addressed later, ask whether it it's satisfactory to not answer the question at the moment.

Timing

One of the most essential elements of a smoothly running workshop is an almost fanatical attention to time. The goal is to balance group participation and the necessity to address all the required content. Time guidelines are just that—guidelines—but if one topic takes longer than it's allotted, something else will have to be cut back.

Some pointers for time management are the following:

- Start on time. At the beginning of the day, after lunch and after breaks, honor those who are on time by beginning instruction. If you decided to wait a few minutes, explain why and how long you will be waiting.
- Check the schedule regularly.
- Deal with digressions firmly but diplomatically.
- Stick to time limits for activities.
- During small group discussions, circulate to make sure groups are staying on task.
- Use a parking lot. Have a flip chart page that you label "Parking Lot." When questions or discussions arise that aren't relevant at the moment, write them on the parking lot. This respects the person who brought it up and allows you to stay on topic. Revisit the parking lot when you have time.

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Language and Literacy Issues

Literacy issues often arise when training roofing workers. A program's objectives may be difficult to achieve if participants are not able to read or write well or if they cannot understand the material for any number of reasons. Often, people do not want to reveal to a group that they can't read, so trainers need to rely on observation to discern whether anyone is struggling with the material. The CERTA program has a written exam and relies on participants filling out peer evaluation forms. If it seems as though someone cannot read, it would be a good idea to talk to him or her during a break. There are ways to work around this, such as giving an oral exam, but never ignore it and certify a trainee who didn't successfully complete all the program elements.

Have Fun!

Training can be fun for you and participants. Be creative and try new activities to engage people in learning; enjoyable training experiences also are usually the most effective training experiences.

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APPENDIX

References to torch-applied roof membrane and flashing systems in the NRCA Roofing Manual: Membrane Roof Systems-2023

Chapter 1-Roof Assembly Configurations

APP Polymer-modified Bitumen Roof System, Two-layer, Torch-applied, Nonnailable Deck (Page 37)
APP Polymer-modified Bitumen Roof System, Two-layer, Torch-applied, Insulated Deck (Page 38)*
SBS Polymer-modified Bitumen Roof System, Two-layer, Torch-applied, Nonnailable Deck (Page 39)
SBS Polymer-modified Bitumen Roof System, Two-layer, Torch-applied, Insulated Deck (Page 40)*
APP Polymer-modified Bitumen Roof System, Two-layer, Torch-applied, Existing Bituminous Roof System (Page 48)*
SBS Polymer-modified Bitumen Roof System, Two-layer, Torch-applied, Existing Bituminous Roof System (Page 50)*
APP Polymer-modified Bitumen Roof System (Temporary), Single -layer, Torch-applied, Nonnailable Deck (Page 53)
SBS Polymer-modified Bitumen Roof System (Temporary), single-layer, Torch-applied, Nonnailable Deck (Page 54)

Chapter 5-Roof Membranes

Section 5.3-Polymer-modified Bitumen Roof Membranes (Pages 200-215)

Chapter 10-Construction Details

Construction details introductory text (Pages 305-336)

Construction Details-Built-up Roof Systems:

- BUR(T)-1—Base Flashing at Parapet Wall With Metal Coping (Torch-applied Flashing Systems)
- BUR-2—Raised Perimeter Edge With Metal Flashing [Fascia Cap] (Hot-, Cold- or Torch-applied Flashing Systems)
- BUR-3—Embedded Edge-metal Flashing [Gravel Stop] (Hot-, Cold- or Torch-applied Flashing Systems)
- BUR-4—Base Flashing With Surface-mounted Counterflashing at Concrete Wall (Hot-, Cold- or Torch-applied Flashing Systems)
- BUR-5—Base Flashing With Two-piece Sheet- metal Counterflashing (Hot-, Cold- or Torch-applied Flashing Systems)
- BUR-6—Base Flashing With Vented Base Sheet (Hot-, Cold- or Torch-applied Flashing Systems)
- BUR(T)-7—Base Flashing at Roof-to-wall Expansion Joint (Torch-applied Flashing Systems)
- BUR(T)-8—Base Flashing at Expansion Joint With Metal Cover (Torch-applied Flashing Systems)
- BUR(T)-9—Base Flashing at Area Divider in Roof System (Torch-applied Flashing Systems)
- BUR(T)-10—Base Flashing at Equipment Support Curb (Torch-applied Flashing Systems)
- BUR-11—Equipment Support Stand and Typical Rain Collar Penetration (Hot-, Cold- or Torch- applied Flashing Systems)
- BUR-12—Base Flashing at Prefabricated Metal Curb (Hot-, Cold- or Torch-applied Flashing Systems)
- BUR(T)-13—Base Flashing at Wood Curb (Torch-applied Flashing Systems)
- BUR(T)-14—Base Flashing at Structural Member Through Roof Deck (Torch-applied Flashing Systems)
- BUR(T)-15—Base Flashing at Sheet-metal Enclosure for Piping Through Roof Deck (Torch-applied Flashing Systems)
- BUR-16—Base Flashing at Sheet-metal Hood for Piping Through Roof Deck (Hot-, Cold- or Torch-applied Flashing Systems)
- BUR(T)-17—Base Flashing at Stack Vent With Curb [Hot or Cold] (Torch-applied Flashing Systems)
- BUR-18—Sheet-metal Stack Vent [Hot or Cold] (Hot-, Cold- or Torch-applied Flashing Systems)
- BUR-19—Plumbing Vent (Hot-, Cold- or Torch- applied Flashing Systems)
- BUR-20A—Penetration Pocket—Single Penetration (Hot-, Cold- or Torch-applied Flashing Systems)
- BUR-21—Penetration Pocket—Double Penetration (Hot-, Cold- or Torch-applied Flashing Systems)
- BUR-22—Pipe Support Curb (Hot-, Cold- or Torch-applied Flashing Systems)
- BUR-22A—Pipe Support (Hot-, Cold- or Torch- applied Flashing Systems)
- BUR-23—Cable Penetration (Hot-, Cold- or Torch-applied Flashing Systems)
- BUR-24—Lightning Protection Terminal (Hot-, Cold- or Torch-applied Flashing Systems)
- BUR-25—Roof Drain (Hot-, Cold- or Torch-applied Flashing Systems)
- BUR-26—Roof Drain with Extension and Temporary Roof System (Hot-, Cold- or Torch-applied Flashing Systems)
- BUR-27—Through-wall Scupper (Hot-, Cold- or Torch-applied Flashing Systems)
- BUR-28—Overflow Scupper (Hot-, Cold- or Torch-applied Flashing Systems)
- BUR-29—Gutter With Perimeter Edge Metal (Hot-, Cold- or Torch-applied Flashing Systems)

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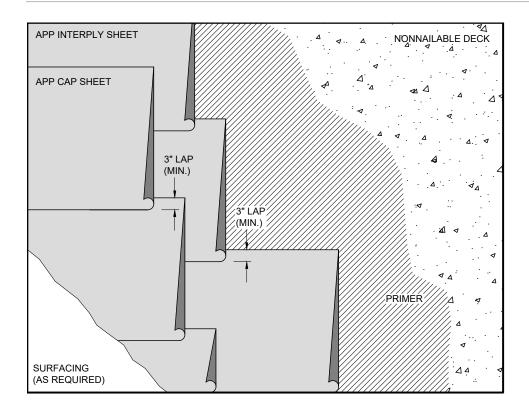
^{*} The use of torch-applied roof membrane products is not recommended for roof systems over combustible roof decks.

Construction Details-Polymer-Modified Bitumen Roof Systems:

- MB(T)-1—Base Flashing at Parapet Wall With Metal Coping (Torch-applied Flashing Systems)
- MB-2—Raised Perimeter Edge With Metal Flashing [Fascia Cap] (Hot-, Cold- or Torch-applied Flashing Systems)
- MB-3—Embedded Edge-metal Flashing [Gravel Stop] (Hot-, Cold- or Torch-applied Flashing Systems)
- MB-3A—Embedded Edge-metal Flashing [Gravel Stop] (Hot-, Cold- or Torch-applied Flashing Systems)
- MB-4—Base Flashing With Surface-mounted Counterflashing at Concrete Wall (Hot-, Cold- or Torch-applied Flashing Systems)
- MB-5—Base Flashing With Two-piece Sheet- metal Counterflashing (Hot-, Cold- or Torch-applied Flashing Systems)
- MB-6—Base Flashing With Vented Base Sheet (Hot-, Cold- or Torch-applied Flashing Systems)
- MB(T)-7—Base Flashing at Roof-to-wall Expansion Joint (Torch-applied Flashing Systems)
- MB(T)-8—Base Flashing at Expansion Joint With Metal Cover (Torch-applied Flashing Systems)
- MB(T)-9—Base Flashing at Area Divider in Roof System (Torch-applied Flashing Systems)
- MB(T)-10—Base Flashing at Equipment Support Curb (Torch-applied Flashing Systems)
- MB-11—Equipment Support Stand and Typical Rain Collar Penetration (Hot-, Cold- or Torch-applied Flashing Systems)
- MB-11A—Equipment Support Stand and Typical Rain Collar Penetration (Hot-, Cold- or Torch-applied Flashing Systems)
- MB-12—Base Flashing at Prefabricated Metal Curb (Hot-, Cold- or Torch-applied Flashing Systems)
- MB(T)-13—Base Flashing at Wood Curb (Torch-applied Flashing Systems)
- MB(T)-14—Base Flashing at Structural Member Through Roof Deck (Torch-applied Flashing Systems)
- MB(T)-15—Base Flashing at Sheet-metal Enclosure for Piping Through Roof Deck (Torch-applied Flashing Systems)
- MB-16—Base Flashing at Sheet-metal Hood for Piping Through Roof Deck (Hot-, Cold- or Torch-applied Flashing Systems)
- MB-16A—Base Flashing at Sheet-metal Hood for Piping Through Roof Deck (Hot-, Cold- or Torch-applied Flashing Systems)
- MB(T)-17—Base Flashing at Stack Vent With Curb [Hot or Cold] (Torch-applied Flashing Systems)
- MB-18—Sheet-metal Stack Vent [Hot or Cold] (Hot-, Cold- or Torch-applied Flashing Systems)
- MB-18A—Sheet-metal Stack Vent [Hot or Cold] (Hot-, Cold- or Torch-applied Flashing Systems)
- MB-19—Plumbing Vent (Hot-, Cold- or Torch- applied Flashing Systems)
- MB-19A—Plumbing Vent (Hot-, Cold- or Torch- applied Flashing Systems)
- MB-20A—Penetration Pocket—Single Penetration (Hot-, Cold- or Torch-applied Flashing Systems)
- MB-20B—Penetration Pocket—Single Penetration (Hot-, Cold- or Torch-applied Flashing Systems)
- MB-21—Penetration Pocket—Double Penetration (Hot-, Cold- or Torch-applied Flashing Systems)
- MB-21A—Penetration Pocket—Double Penetration (Hot-, Cold- or Torch-applied Flashing Systems)
- MB-22—Pipe Support Curb (Hot-, Cold- or Torch-applied Flashing Systems)
- MB-22A—Pipe Support (Hot-, Cold- or Torch- applied Flashing Systems)
- MB-23—Cable Penetration (Hot-, Cold- or Torch-applied Flashing Systems)
- MB-23A—Cable Penetration (Hot-, Cold- or Torch-applied Flashing Systems)
- MB-24—Lightning Protection Terminal (Hot-, Cold- or Torch-applied Flashing Systems)
- MB-25—Roof Drain (Hot-, Cold- or Torch-applied Flashing Systems)
- MB-25A—Roof Drain (Hot-, Cold- or Torch-applied Flashing Systems)
- MB-26—Roof Drain with Extension and Temporary Roof System (Hot-, Cold- or Torch-applied Flashing Systems)
- MB-27—Through-wall Scupper (Hot-, Cold- or Torch-applied Flashing Systems)
- MB-28—Overflow Scupper (Hot-, Cold- or Torch-applied Flashing Systems)
- MB-29—Gutter With Perimeter Edge Metal (Hot-, Cold- or Torch-applied Flashing Systems)
- MB-29A—Gutter With Perimeter Edge Metal (Hot-, Cold- or Torch-applied Flashing Systems)

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NRCA Polymer-modified Bitumen Roof Systems—New Construction or Roof Replacement APP Polymer-modified Bitumen Roof System, Two-layer, Torch-applied, Nonnailable Deck



Roof Slope Limitations

Refer to Section 2.1—Guidelines Applicable to All Roof Deck Types

- Minimum slope for new construction: 1/4:12
- Minimum slope for roof replacement: Positive drainage

Nonnailable Deck Types

Refer to Chapter 2-Roof Decks

• Structural concrete—Section 2.5

Roof Membrane

Refer to Section 5.3—Polymer-modified Bitumen Roof Membranes for detailed information

• Select primer (if applicable), APP interply sheet and APP cap sheet

Flashings

Refer to Section 5.3—Polymer-modified Bitumen Roof Membranes and Chapter 10—Construction Details

• Select specific flashing materials and identify construction detail configurations

Surfacing (if applicable)

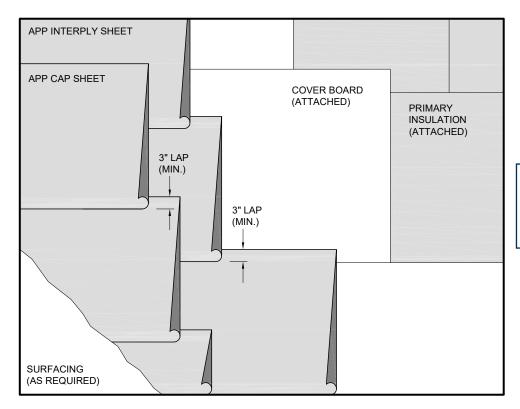
Refer to Chapter 7—Surfacings

• Select specific surfacing materials

Roof Accessories (if applicable)

NRCA Polymer-modified Bitumen Roof Systems—New Construction or Roof Replacement

APP Polymer-modified Bitumen Roof System, Two-layer, Torch-applied, Insulated Deck



The use of torch-applied roof membrane products is not recommended for roof systems over combustible roof decks.

Roof Slope Limitations

Refer to Section 2.1—Guidelines Applicable to All Roof Deck Types

- Minimum slope for new construction: 1/4:12
- Minimum slope for roof replacement: Positive drainage

Air and Vapor Retarder Types (if applicable)

Refer to Chapter 3—Air and Vapor Retarders

Rigid Board Insulation

Refer to Chapter 4-Rigid Board Insulation

 Select primary insulation layer type and thickness; cover board type and thickness; tapered insulation (if applicable); and method of attachment for insulation layers

Roof Membrane

Refer to Section 5.3—Polymer-modified Bitumen Roof Membranes

Select APP interply sheet and APP cap sheet

Flashings

Refer to Section 5.3—Polymer-modified Bitumen Roof Membranes and Chapter 10—Construction Details

> Select specific flashing materials and identify construction detail configurations

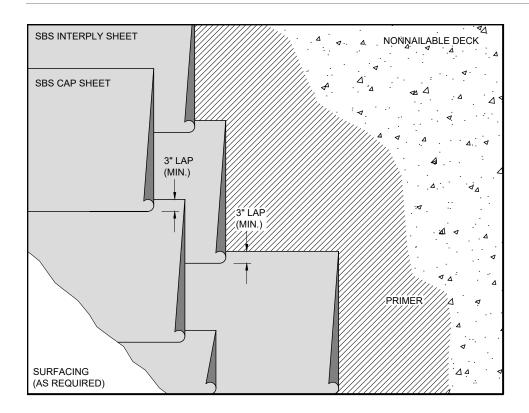
Surfacing (if applicable)

Refer to Chapter 7-Surfacings

Select specific surfacing materials

Roof Accessories (if applicable)

NRCA Polymer-modified Bitumen Roof Systems—New Construction or Roof Replacement SBS Polymer-modified Bitumen Roof System, Two-layer, Torch-applied, Nonnailable Deck



Roof Slope Limitations

Refer to Section 2.1—Guidelines Applicable to All Roof Deck Types

- Minimum slope for new construction: 1/4:12
- Minimum slope for roof replacement: Positive drainage
- Consult manufacturer for slopes greater than 2:12

Nonnailable Deck Types

Refer to Chapter 2-Roof Decks

• Structural concrete—Section 2.5

Roof Membrane

Refer to Section 5.3—Polymer-modified Bitumen Roof Membranes

• Select asphalt primer (if applicable), SBS interply sheet and SBS cap sheet

Flashings

Refer to Section 5.3—Polymer-modified Bitumen Roof Membranes and Chapter 10—Construction Details

> Select specific flashing materials and identify construction detail configurations

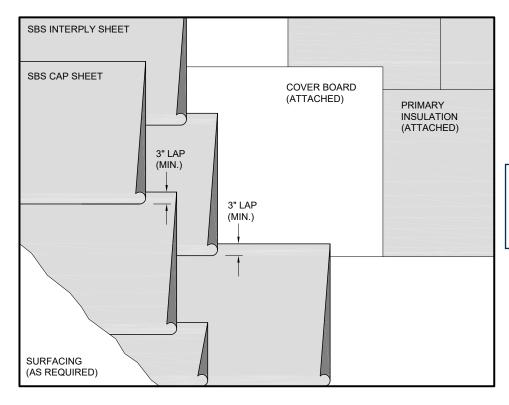
Surfacing (if applicable)

Refer to Chapter 7—Surfacings

Select specific surfacing materials

Roof Accessories (if applicable)

NRCA Polymer-modified Bitumen Roof Systems—New Construction or Roof Replacement SBS Polymer-modified Bitumen Roof System, Two-layer, Torch-applied, Insulated Deck



The use of torch-applied roof membrane products is not recommended for roof systems over combustible roof decks

Roof Slope Limitations

Refer to Section 2.1—Guidelines Applicable to All Roof Deck Types

- Minimum slope for new construction: 1/4:12
- Minimum slope for roof replacement: Positive drainage
- Back-nailing for slopes greater than 2:12

Air and Vapor Retarder Types (if applicable) Refer to Chapter 3—Air and Vapor Retarders

Rigid Board Insulation

Refer to Chapter 4—Rigid Board Insulation

 Select primary insulation layer type and thickness; cover board type and thickness; tapered insulation (if applicable); and method of attachment for insulation layers

Roof Membrane

Refer to Section 5.3—Polymer-modified Bitumen Roof Membranes for detailed information

• Select SBS interply sheet and SBS cap sheet

Flashings

Refer to Section 5.3—Polymer-modified Bitumen Roof Membranes and Chapter 10—Construction Details

> Select specific flashing materials and identify construction detail configurations

Surfacing (if applicable)

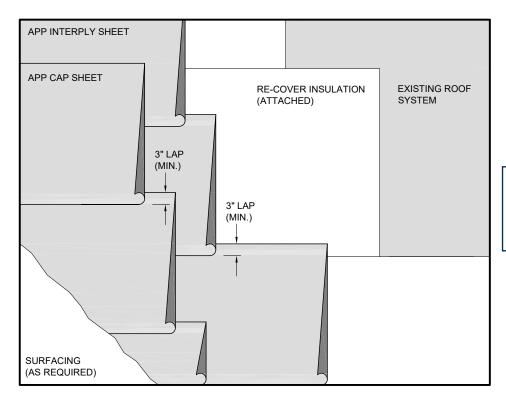
Refer to Chapter 7—Surfacings

· Select specific surfacing materials

Roof Accessories (if applicable)

NRCA Polymer-modified Bitumen Roof Systems—Roof Re-cover

APP Polymer-modified Bitumen Roof System, Two-layer, Torch-applied, Existing Bituminous Roof System



The use of torch-applied roof membrane products is not recommended for roof systems over combustible roof decks.

Roof Slope Limitations

Refer to Section 2.1—Guidelines Applicable to All Roof Deck Types

• Minimum slope: Positive drainage

Existing Roof System Types

Refer to Section 9.2 through 9.6

Re-cover Insulation

Refer to Chapter 4—Rigid Board Insulation

 Select a re-cover board type and thickness, and method of attachment

Roof Membrane

Refer to Section 5.3—Polymer-modified Bitumen Roof Membranes

Select APP interply sheet and APP cap sheet

Flashings

Refer to Section 5.3—Polymer-modified Bitumen Roof Membranes and Chapter 10—Construction Details

> Select specific flashing materials and identify construction detail configurations

Surfacing (if applicable)

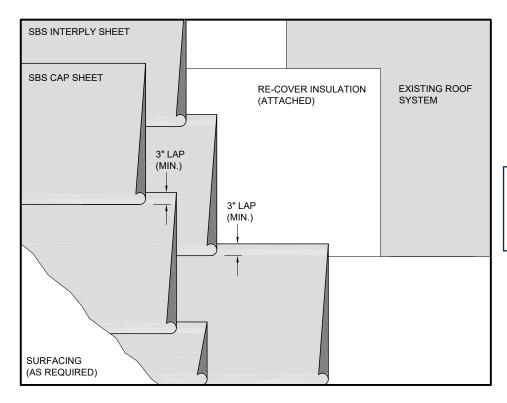
Refer to Chapter 7—Surfacings

· Select specific surfacing materials

Roof Accessories (if applicable)

NRCA Polymer-modified Bitumen Roof Systems—Roof Re-cover

SBS Polymer-modified Bitumen Roof System, Two-layer, Torch-applied, Existing Bituminous Roof System



The use of torch-applied roof membrane products is not recommended for roof systems over combustible roof decks.

Roof Slope Limitations

Refer to Section 2.1—Guidelines Applicable to All Roof Deck Types

- Minimum slope: Positive drainage
- Back-nailing for slopes greater than 2:12

Existing Roof System Types

Refer to Section 9.2 through 9.6

Re-cover Insulation

Refer to Chapter 4-Rigid Board Insulation

 Select a re-cover board type and thickness, and method of attachment

Roof Membrane

Refer to Section 5.3—Polymer-modified Bitumen Roof Membranes

• Select SBS interply sheet and SBS cap sheet

Flashings

Refer to Section 5.3—Polymer-modified Bitumen Roof Membranes and Chapter 10—Construction Details

> Select specific flashing materials and identify construction detail configurations

Surfacing (if applicable)

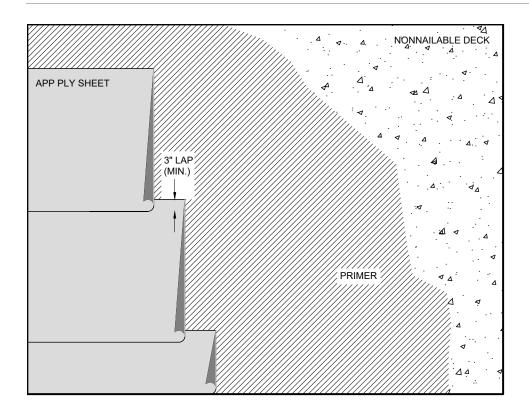
Refer to Chapter 7—Surfacings

• Select specific surfacing materials

Roof Accessories (if applicable)

NRCA Polymer-modified Bitumen Roof Systems—Temporary Roof

APP Polymer-modified Bitumen Roof System (Temporary), Single-layer, Torch-applied, Nonnailable Deck



Roof Slope and Drainage Limitations

Refer to Section 2.1—Guidelines Applicable to All Roof Deck Types and Appendix 3—Temporary Roof Systems

Roof Deck

Refer to Chapter 2-Roof Decks

• Structural concrete—Section 2.5

Roof Membrane

Refer to Section 5.3—Polymer-modified Roof Membranes

Select asphalt primer and smooth APP polymer-modified bitumen sheet

Flashings

Refer to Section 5.3—Polymer-modified Roof Membranes

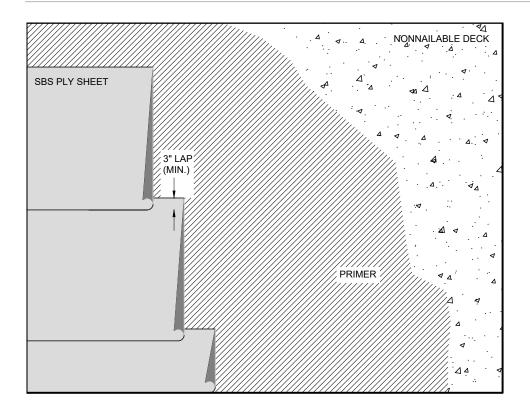
• Select specific flashing materials and identify construction detail configurations

Surfacing:

• None

NRCA Polymer-modified Bitumen Roof Systems—Temporary Roof

SBS Polymer-modified Bitumen Roof System (Temporary), Single-layer, Torch-applied, Nonnailable Deck



Roof Slope and Drainage Limitations

Refer to Section 2.1—Guidelines Applicable to All Roof Deck Types and Appendix 3—Temporary Roof Systems

Roof Deck

Refer to Chapter 2—Roof Decks

• Structural concrete—Section 2.5

Roof Membrane

Refer to Section 5.3—Polymer-modified Roof Membranes

• Select asphalt primer and smooth SBS polymer-modified bitumen sheet

Flashings

Refer to Section 5.3—Polymer-modified Roof Membranes

• Select specific flashing materials and identify construction detail configurations

Surfacing

• None

is not required. Irregularities, such as fishmouths, should be cut and patched before applying the next sequential ply. Buckles, ridges and blisters should be repaired before applying surfacing.

Phased application of built-up roofing plies is not recommended. However, if conditions do not allow installation of the complete roof membrane and a work area must be left incomplete overnight, NRCA recommends the incomplete membrane be visually inspected, any fishmouths be repaired and a thin squeegee coat of hot bitumen be applied before workers leave the work area for the night. The surface should be dry and clean before additional plies are installed.

An effort should be made to limit traffic over recently installed plies until the bitumen has cooled and set to minimize displacement of fresh bitumen.

Membrane Flashing Application: Membrane flashing configurations for common construction detail conditions are depicted in Chapter 10—Construction Details. Construction details specific to built-up roof membranes are denoted as "BUR-" followed by a number and possibly a letter (e.g., BUR-1, BUR-2, BUR-3).

The manufacturer of the specific built-up membrane roof system being installed should be consulted for its specific recommendations for membrane flashing materials and application.

For torch-applied, polymer-modified bitumen membrane flashings, NRCA recommends the design and application of membrane flashing be done in accordance with the CERTA roof torch safety program. Additional information regarding CERTA is provided in Chapter 10—Construction Details.

Surfacing Application: Applying surfacing at a time interval other than when the membrane is applied is not considered by NRCA to be a phased application.

Before application of mineral-surfaced cap sheets, the cap sheet should be unrolled; cut into workable lengths; and allowed to lie flat, relax and reduce roll memory and the possibility of curling. Other membrane surfacing options include a flood coat of hot bitumen and aggregate or liquid-applied coatings. Additional information regarding these membrane surfacing options is provided in Chapter 7—Surfacings.

Additional Information: NRCA suggests consulting the membrane manufacturer's literature for additional application guidelines and recommendations. Additional information regarding the application of built-up roof membranes is provided in NRCA's Application Techniques for Glass Fiber Roofing Felts. Guidelines for quality control and quality assurance during the application of built-up membrane roof systems is provided in NRCA's Quality Control and Quality-assurance Guidelines for the Application of Membrane Roof Systems.

Refer to Chapter 1—Roof System Configurations in this manual for additional information about installing built-up membrane roof systems.

5.3—Polymer-modified Bitumen Roof Membranes

In addition to the information in this section, information contained in Section 5.1—Guidelines Applicable to All Membrane Types also applies to polymer-modified bitumen roof membranes.

Polymer-modified bitumens were developed in Europe during the mid-1960s and have been used in North America since about 1975.

Polymer-modified roof membranes are composed of reinforcing fabrics, usually polyester, fiberglass or both, that serve as the carriers for the polymer-modified bitumen as it is manufactured into a roll material. The purposes for reinforcements in polymer-modified bitumen sheets essentially are the same as felts in built-up roof membranes. The reinforcements help keep the bitumen in place within the sheet, provide tensile strength and allow for varying degrees of sheet elongation.

The reinforcing fabric, bitumen and polymers used in polymer-modified bitumen sheet product must be carefully selected and properly formulated to result in a successful roofing material. In the manufacturing process, the reinforcing fabrics are

saturated, impregnated, or filled and coated with the polymer-modified bitumen. The end result is a relatively strong, heavyweight roof membrane material.

There are two general types of polymer-modified asphalts: those with asphalt modified with atactic polypropylene polymer and those with asphalt modified with styrene butadiene styrene polymer. These two general types of polymer modifiers give rise to materials that differ in physical characteristics, as well as chemical composition. Generally, APP polymers modify the asphalt to give the resultant material a "plasticized" nature. SBS polymers modify the asphalt to give the resultant material a "rubberized" nature.

Polymer-modified bitumen roof membranes, after first being introduced in North America, sometimes were specified in single-layer configurations. NRCA does not recommend the use of polymer-modified bitumen roof membranes where only one layer of roofing material is installed except where used as a temporary roof membrane.

Currently, most polymer-modified bitumen roof membrane specifications employ multiple-layer configurations consisting of a base layer or plies and a polymer-modified bitumen membrane cap sheet. APP and SBS polymer-modified bitumen products can be used over a multiple-ply fiberglass-reinforced built-up roof membrane.

Roofing with polymer-modified bituminous materials is largely similar to built-up roofing in that roll materials are used in redundant manners to effectively build up a durable, multiple-ply roof membrane. Many of the polymer-modified bitumen sheet materials typically contain enough bitumen to provide for relatively low perm ratings, which make them weatherproof membranes. These reinforced sheets do not need interply layers of bitumen to provide the weatherproofing component for the roof system. The bitumen, either hot- or cold-applied, then is used as an adhesive to adhere the polymer-modified bitumen sheets together or to a substrate.

The principal components used in constructing polymer-modified bitumen roof membranes are:

- Adhesives
- Base layer, such as a base membrane or interply sheets
- Polymer-modified bitumen cap sheet
- Membrane flashings
- Accessories

Adhesives: Several categories of adhesives are used in constructing polymer-modified bitumen roof membranes:

- Cold-applied asphalt adhesives
- Cold-applied polymeric adhesives
- · Hot-applied asphalts
- Hot-applied polymer-modified asphalts

Cold-applied Asphalt Adhesives: Asphalt adhesives that are thinned or cut back with solvents are available in various forms for use in constructing polymer-modified bitumen roof membranes. When an asphalt is thinned with solvent, its material state changes; what was once a solid material at normal ambient rooftop temperatures becomes a liquid material. These liquid versions of asphalt are referred to as "cutbacks." Cutting the asphalt back with solvents makes it possible to apply the asphalt adhesive without heating it in a kettle or tanker. Formulations of most solvent-based asphalt adhesives use cutbacks as the starting point.

These adhesives also contain other ingredients, such as mineral stabilizers, fibers, surfactants and solvent. These components improve the weatherability, reduce fire potential, increase resistance to flow on slopes, and enhance the stability and overall performance of the adhesive.

Mineral stabilizers, such as calcium carbonate and clay, improve the weatherability of the asphalt and improve its resistance to fire and flow of the adhesive after application. Cellulose (organic) or polyester (inorganic) fibers also are added to improve flow

resistance and strength of the cured adhesive layer. Surfactants are used to improve the compatibility of these components with the asphalt and solvents blended in. All these components then are blended with special mixing equipment to ensure the solids will not settle within the container during shipment and storage.

Note: Asbestos fibers were a traditional fiber used in cold-applied asphalt adhesives. Asbestos, an inorganic fiber sourced through mining, provided fire resistance, flow resistance and strength of the cured adhesive layer. Asbestos fibers have been found to be hazardous when airborne and are rarely used in this product type anymore.

The solvents used in this class of adhesive range from mineral spirits to toluene. Mineral spirits, also referred to as naptha or Stoddard solvent, is a mixture of aliphatic hydrocarbons. Toluene, an aromatic hydrocarbon, is a stronger solvent, but there are differences between these two types of solvent that may need to be considered by the user (applicator) and the potential effect on the occupants of the structure on which the adhesive is being applied.

Mineral spirits has the advantage of a lower odor threshold, which can be less intrusive for building occupants during application. It also has a higher flash point, which makes it a Department of Transportation combustible adhesive rather than flammable, which can provide a greater margin of safety during shipping and application. A potential drawback of mineral spirits adhesives is a slower cure rate compared with other adhesives that use toluene as the solvent. However, toluene has a stronger odor, and products using it are classified as a DOT flammable. The advantage of adhesives using toluene is the solvent will flash off faster than mineral spirits, so the adhesive will cure faster than those using mineral spirits solvent.

Products in this category typically are applied by spray, brush, roller or squeegee. However, manufacturers commonly describe the conditions required for each application method. For instance, depending on product and site conditions, spray applica-

tion may require specific spraying equipment and/ or preheating a product to obtain material within a specified temperature range at the spray tip. For squeegee applications, a squeegee with a serrated or notched profile may be required to obtain an application within the specified thickness range. Manufacturers recommend specific application rates for different substrates and membranes. Flash-off times are product-specific and vary with site conditions.

NRCA recommends product-specific manufacturer application instructions be followed when using cold-applied asphalt adhesives.

When cold-applied solvent-based asphalt adhesive is specified for use in constructing polymer-modified bitumen roof membranes, ASTM D3019, "Standard Specification for Lap Cement Used with Asphalt Roll Roofing, Non-Fibered, and Fibered," or ASTM D4479, "Standard Specification for Asphalt Roofing Coatings, Asbestos Free," typically apply. Though ASTM D4479 scope does not indicate the standard addresses adhesives, ASTM D4479-compliant materials commonly are used for bonding bituminous sheets together or to substrates.

ASTM D3019 includes two type classifications that differentiate between products addressed by the standard. ASTM D3019, Type I designates a brush consistency cement that contains no mineral or other stabilizers. ASTM D3019, Type III designates a heavy brushing or light troweling consistency cement that contains a quantity of mineral or other stabilizers or both but contains no asbestos. Most solvent-based asphalt products currently available for use in constructing polymer-modified bitumen roof membranes comply with ASTM D3019, Type III specification.

ASTM D 4479 includes two type classifications that differentiate between products addressed by the standard. ASTM D4479, Type I designates an asphaltic material of brushing or spraying consistency made from asphalt characterized as self-healing, adhesive and ductile. ASTM D4479, Type II designates an asphaltic material of brushing or spraying con-

sistency made from asphalts characterized by high softening point and relatively low ductility.

NRCA recommends designers specify cold-applied solvent-based asphalt adhesives for polymer-modified bitumen membranes based on their ASTM designation, including desired type classification.

Cold-applied Polymeric Adhesives: Materials in this category use specially modified roofing asphalts and are intended for use as interply adhesives and aggregate surfacing adhesives. Cold-applied polymeric adhesive products span a broad range of formulations, from those with solvent contents typical of cold-applied asphalt adhesives to others marketed as solvent-free and/or that include relatively low to no asphalt content to multicomponent adhesives mixed just before application. Products in this category include styrene ethylene butadiene styrene-modified asphalt adhesives, one-part and two-part polyurethane-modified adhesives, and polyether-modified adhesives.

Application instructions for cold-applied polymeric adhesives typically indicate squeegee, brush, roller or spray application. Manufacturers commonly describe the conditions required for each application method. For instance, depending on product, spray application may require specific spraying equipment and/or preheating a product to obtain material within a specified temperature range at the spray tip. For squeegee applications, a squeegee with a serrated or notched profile may be required to obtain an application within the specified thickness range. Manufacturers provide specific application rates for different substrates and membranes. Flashoff and cure times are product-specific and vary with site conditions.

NRCA recommends product-specific manufacturer application instructions be followed when using cold-applied polymeric adhesives.

Currently, no ASTM standard specifications applicable to cold-applied polymeric adhesives exist. Product compositions are proprietary, and intended use, application and storage

recommendations are product-specific.

NRCA recommends designers specify cold-applied polymeric adhesives for polymer-modified bitumen roof membranes in accordance with manufacturers' directions and limitations of use.

Hot-applied Asphalts: For polymer-modified bitumen membranes, hot-applied asphalt often is used as a mopping bitumen for adhering base sheets and assembling interply base layers. Hot-applied asphalt sometimes also is used as an adhesive for applying SBS polymer-modified base and cap sheets.

For polymer-modified bitumen membrane application, the same type of asphalt used when constructing built-up membranes is commonly used—asphalt complying with ASTM D312, "Standard Specification for Asphalt Used in Roofing." Generally, ASTM D312, Type III (Steep) or ASTM D312, Type IV (Special Steep) asphalt is used with polymer-modified bitumen membranes.

When polymer-modified bitumen membrane materials are specified to be installed in hot bitumen, the EVT range recommendation generally is not applicable. Most manufacturers of polymer-modified bitumen cap sheets recommend mopping asphalt used for SBS polymer-modified bitumen cap sheet application be as hot as possible without overheating the asphalt in the kettle or tanker. Manufacturers' guidelines for using mopping asphalt for SBS polymer-modified bitumen cap sheets vary somewhat. Designers should consult with manufacturers of SBS polymer-modified bitumen products for their specific guidelines.

Additional information about mopping asphalt used in polymer-modified bitumen membrane application can be found in Section 5.2—Built-up Roof Membranes.

Hot-applied Polymer-modified Asphalts: Hot-applied SBS polymer-modified membrane systems are available that use polymer-modified roofing asphalt for adhering base sheets and cap sheets, assembling interply sheets and adhering aggregate surfacing. The polymer-modified asphalt is made

from standard roofing asphalt modified through the addition of styrene ethylene butadiene styrene copolymer. The SEBS modifier may improve physical properties of standard roofing asphalt, such as cold-temperature flexibility and ultraviolet light resistance. The SEBS modifier also is resistant to polymer breakdown while being heated to application temperature in direct tube fired roofing kettles.

When hot-applied polymer-modified asphalt is specified as adhesive for polymer-modified roof membranes, NRCA recommends designers specify materials that comply with ASTM D6152, "Standard Specification for SEBS-Modified Mopping Asphalt Used In Roofing."

When hot-applied polymer-modified asphalts are used for polymer-modified bitumen roof membrane construction, the EVT range concept does not apply.

Additional information about hot-applied polymer-modified asphalt used in polymer-modified bitumen membrane application can be found in Section 5.2—Built-up Roof Membranes.

Base Layer: The base layer of base sheets or base plies used beneath APP and SBS polymer-modified bitumen membranes serve several functions, including to separate a roof membrane from a substrate; provide support for a membrane over slightly rough or irregular substrates; serve as an attachment or base layer for the adhesion of rigid insulation board on nailable roof decks; serve as a bottom layer in multiple-layer polymer-modified bitumen roof membranes; serve as temporary roof systems or vapor retarders; and minimize the potential for bitumen drippage.

Base Sheets: Polymer-modified bitumen-coated base sheets can work well to separate a roof membrane from a substrate. When mechanically attached, a base sheet can serve as a separation layer or adhesive bond break between the roof deck and membrane so the membrane may move thermally, independently from the roof deck.

Over decks that have slightly irregular surfaces, such as cold joints in concrete decks, heavyweight polymer-modified bitumen base sheets can help

smooth substrates and provide acceptable surfaces for adhering the remainder of the polymer-modified roof membrane. Similarly, on wood and other nailable roof decks, a base sheet works well to help cover joints in the roof deck, and when mechanically fastened to the deck, a base sheet can provide a good surface for adhering the remainder of the polymer-modified roof system.

Polymer-modified bitumen-coated base sheets with strong reinforcement can serve as first layers to add integrity and strength to multiple-ply polymer-modified roof membranes and temporary roof systems. They also make excellent vapor retarders because of their low permeance ratings.

The following base sheets are used with polymermodified bitumen roof membranes:

- Asphalt-coated Fiberglass-mat Base Sheet: Asphalt-coated fiberglass-mat base sheet is composed of a fiberglass mat impregnated and coated with asphalt and not modified with a chemical polymer. This base sheet often is specified with multiple-ply polymer-modified bitumen roof membranes. Asphalt-coated fiberglass base sheets should meet or exceed the requirements set forth in ASTM D4601, "Standard Specification for Asphalt-Coated Glass Fiber Base Sheet Used in Roofing."
- Asphalt-coated Fiberglass Venting Base Sheet: Some manufacturers make a special heavy base sheet with mineral granules on the underside of the sheet for venting certain deck conditions. Asphalt-coated fiberglass venting base sheets should meet or exceed the requirements set forth in ASTM D4897, "Standard Specification for Asphalt-Coated Glass-Fiber Venting Base Sheet Used in Roofing."

In some cases, these venting sheets are specified for use over lightweight insulating concrete substrates and other substrates as base sheets. Some may be mechanically fastened and/or spot mopped with

hot bitumen. If a base sheet does not have pre-punched holes used to facilitate partial adhesion and the sheet is to be adhered, spot mopping, preferably with a mechanical bitumen dispenser, may be necessary to prevent solid adhesion of the base sheet, which could restrict its venting properties.

• SBS Polymer-modified Asphalt-coated Base Sheet: SBS polymer-modified asphalt-coated base sheets are manufactured in several weights and thicknesses. Most SBS polymer-modified bitumen base sheets are composed of polyester or fiberglass mats saturated, impregnated or filled, and coated on both sides with polymer-modified asphalt. At least three weights of polymer-modified bitumen base sheets are common, and all are available for use as base plies in the construction of multiple-ply polymer-modified bitumen roof membranes.

The U.S. product standards applicable to SBS polymer-modified bitumen base sheets are, depending on reinforcement type, ASTM D6163, "Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements," and ASTM D6164, "Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcement." Within each of these standards, type classifications such as Type I, Type II and Type III differentiate among products characterized by different minimum mechanical strength properties. Within these standards, grade classifications differentiate among products by surfacing type: Grade G designates granule surfacing, and Grade S designates smooth surfacing. Smooth-surfaced sheets are used as base sheets.

• APP Polymer-modified Asphalt-coated Base Sheet: APP polymer-modified as-

phalt-coated base sheets are manufactured in several different weights and thicknesses. Most APP polymer-modified bitumen base sheets are composed of a polyester or fiberglass mat saturated, impregnated or filled, and coated on both sides with polymer-modified asphalt. APP polymer-modified bitumen base sheets are used as base plies in the construction of multiple-ply polymer-modified bitumen roof membranes, as backer plies for flashing systems and any other use requiring a thicker base sheet.

The U.S. product standard applicable to APP polymer-modified asphalt-coated base sheets is ASTM D6509, "Specification for Atactic Polypropylene (APP) Modified Bituminous Base Sheet Materials Using Glass Fiber Reinforcements."

• Self-adhering Polymer-modified Bitumen Base Sheets: SA polymer-modified bitumen base sheets generally are reinforced with fiberglass mats, though some are polyester-reinforced. The self-adhesive polymer blend is factory-applied to the bottom side and occasionally to the top and bottom. The adhesive is faced with a release film or paper incorporated onto the adhesive to prevent sticking in the roll and aid in placement of the roll during installation.

Interply Sheets: In place of single-layer base sheets, the following sheets, sometimes referred to as "interply sheets," often are used in multiple layers beneath APP or SBS polymer-modified bitumen sheets.

• Asphalt, Fiberglass Ply Sheet: Asphalt, fiberglass ply sheets, Types IV and VI, often are specified to serve as interply sheets in hybrid built-up roof membranes that sometimes are referred to as polymer-modified bitumen roof membranes. Type IV and Type VI fiberglass ply sheets are lighter in weight than typical polymer-modified bitumen sheets used as interply sheets in

multiple-ply polymer-modified bitumen roof membranes. Asphalt, fiberglass ply sheets (Type IV and Type VI) should meet or exceed the requirements set forth in ASTM D2178, "Standard Specification for Asphalt Glass Felt Used in Roofing and Waterproofing."

• APP Polymer-modified Interply Sheets: Smooth-surfaced APP polymer-modified bitumen sheets may be used as the interply sheet component of APP polymer-modified bitumen membranes. There are two general types of APP polymer-modified bitumen sheets used in this application: APP polymer-modified asphalt-coated, fiberglass-reinforced sheet or APP polymer-modified asphalt-coated, polyester-reinforced sheet.

These materials are manufactured in different weights and thicknesses. Most APP polymer-modified bitumen sheets are composed of a polyester or fiberglass mat saturated, impregnated or filled, and coated on both sides with APP polymer-modified asphalt.

These APP polymer-modified bitumen sheets are manufactured as smooth-surfaced sheets; therefore, they regularly are used interchangeably as base sheets and interply sheets in multiple-ply APP polymer-modified bitumen roof membranes.

Polyester-reinforced sheets are most common, but there are several fiberglassreinforced sheets available.

Depending on reinforcement type, APP polymer-modified, asphalt-coated reinforced sheets should comply with ASTM D6222, "Standard Specification for Atactic Polypropylene (APP) Modified Bituminous Sheet Materials Using Polyester Reinforcements"; ASTM D6223, "Standard Specification for Atactic Polypropylene (APP) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber

Reinforcements"; or ASTM D6509, "Specification for Atactic Polypropylene (APP) Modified Bituminous Base Sheet Materials Using Glass Fiber Reinforcements." Within the former two standards, classifications such as Type I and Type II differentiate among products by dimension, mass and physical properties. Also, within these standards, grade classifications differentiate among products by surfacing type: Grade G designates granule surfacing, and Grade S designates smooth surfacing. Smooth-surfaced Grade S sheets are appropriate for use as interply sheets.

• SBS Polymer-modified Bitumen Interply Sheets: Smooth-surfaced SBS polymer-modified bitumen sheets may be used as the interply sheet component of SBS polymer-modified bitumen membranes. There are two general types of SBS polymer-modified bitumen sheets used in this application: SBS polymer-modified asphalt-coated, fiberglass-reinforced sheet and SBS polymer-modified asphalt-coated, polyester-reinforced sheet.

These materials are manufactured in different weights and thicknesses. Most SBS polymer-modified bitumen sheets are reinforced with polyester, fiberglass (scrim or mat) or both types of reinforcements. The fabrics are saturated, impregnated or filled, and coated on both sides with polymer-modified asphalt.

These SBS polymer-modified bitumen sheets are manufactured as smooth-surfaced sheets; therefore, they regularly are used interchangeably as base sheets and interply sheets in multiple-ply SBS polymer-modified bitumen roof membranes. They are available with fiberglass and/or polyester reinforcement.

Depending on reinforcement type, SBS polymer-modified asphalt-coated rein-

forced sheets comply with ASTM D6162, "Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements"; ASTM D6163, "Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements"; or ASTM D6164, "Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements." Within each of these standards, type classifications such as Type I, Type II and Type III differentiate among products characterized by different minimum mechanical strength properties. Also, within these standards, grade classifications differentiate among products by surfacing type: Grade G designates granule surfacing, and Grade S designates smooth surfacing. Smooth-surfaced Grade S sheets are appropriate for use as interply sheets.

• Self-adhering Polymer-modified Bitumen Interply Sheets: Self-adhering polymer-modified bitumen interply sheets generally are reinforced with fiberglass mats though some are polyester-reinforced. The self-adhesive polymer blend is factoryapplied to the bottom side and occasionally to the top and bottom. The adhesive is faced with a release film or paper incorporated onto the adhesive to prevent sticking in the roll and aid in placement of the roll during installation.

The use of single- or double-sided sheets is dictated by the manufacturer's systems configuration for nailable and nonnailable substrates. Single-sided, self-adhering polymer-modified bitumen sheets may be topside-surfaced with a parting agent such as talc, sand or fine granules. Interply sheets are produced in a variety of weights and thicknesses.

Polymer-modified Bitumen Membrane Cap

Sheet: Polymer-modified bitumen sheets are made with polyester and/or fiberglass reinforcements. Most manufacturers of polymer-modified bitumen roll materials produce materials in which the reinforcements are filled, saturated or coated.

All polymer-modified bitumen-coated sheets are factory-coated on one or both sides with polymer-modified bitumen. Some sheets are surfaced on one or both sides with fine minerals, such as sand, mica or talc, that serve as parting agents and prevent adhesion of the material while in roll form. Some manufacturers use liquid parting agents, and others use plastic films removed by hand or intended to be burned off during the installation.

Polymer-modified bitumen sheets are produced in various weights and with various reinforcements. Many smooth-surfaced sheets are used as base sheets, interply sheets and top ply sheets in multiple-ply polymer-modified bitumen membranes. Granule-surfaced and metal foil laminate sheets generally serve as cap and flashing sheets. Most recently, a large variety of reflective cap sheets have been available. Products in this category include granule-surfaced sheets with additional factoryapplied coating, smooth sheets with factory-applied coating and sheets with factory-applied thermoplastic film surfacing.

ASTM International has published four standards for SBS polymer-modified bitumen sheets, establishing separate standards for sheets reinforced and/or surfaced with different types of materials.

These standards are:

- ASTM D6162, "Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements"
- ASTM D6163, "Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Glass Fiber Reinforcements"

- ASTM D6164, "Standard Specification for Styrene Butadiene Styrene (SBS) Modified Bituminous Sheet Materials Using Polyester Reinforcements"
- ASTM D6298, "Standard Specification for Fiberglass Reinforced Styrene Butadiene Styrene (SBS) Modified Bituminous Sheets with a Factory Applied Metal Surface"

ASTM International has published three standards for APP polymer-modified bitumen sheets, establishing separate standards for sheets reinforced with different types of materials.

These standards are:

- ASTM D6222, "Standard Specification for Atactic Polypropylene (APP) Modified Bituminous Sheet Materials Using Polyester Reinforcements"
- ASTM D6223, "Standard Specification for Atactic Polypropylene (APP) Modified Bituminous Sheet Materials Using a Combination of Polyester and Glass Fiber Reinforcements"
- ASTM D6509, "Specification for Atactic Polypropylene (APP) Modified Bituminous Base Sheet Materials Using Glass Fiber Reinforcements"

Within each of these standards except ASTM D6509, classifications such as Type I and Type II differentiate among products by dimension, mass and physical properties. Also within these standards, grade classifications differentiate among products by surfacing type: Grade G designates granule surfacing, and Grade S designates smooth surfacing.

Self-adhering Polymer-modified Bitumen Cap Sheets: Self-adhering polymer-modified bitumen cap sheet membranes are roll products with a self-adhesive compound on the bottom side. Self-adhering membranes usually do not require a cold adhesive, hot bitumen or torch heat to activate the adhesive bonding properties. The self-adhesive is

a composite blend of asphalt, polymer, fillers and selected resins. The resins are introduced in various proportions to adjust the tackiness of the adhesive.

A majority of self-adhering polymer-modified bitumen membranes use SBS as the primary polymer modifier; others use APP or TPO polymers. Membrane configuration uses the same polymer blend on the top side and underside of the reinforcement or uses the primary polymer on the top side and a separate polymer blend for the underside adhesive. The adhesive is faced with a release film or paper incorporated onto the adhesive to prevent sticking in the roll and aid in placement of the roll during installation.

Self-adhering polymer-modified bitumen roof systems for low-slope applications were developed using concepts originally applied in the development of self-adhering polymer-modified bitumen underlayment products used with steep-slope systems. Self-adhering polymer-modified bitumen products intended for use as underlayments should not be incorporated into low-slope membrane roof systems. Advancements in polymer technology and environmental pressures on conventional built-up and polymer-modified bitumen roof systems have accelerated the development of self-adhering polymer-modified bitumen products. Manufacturers offer multiple-ply self-adhering polymer-modified bitumen roof systems, as well as a combination of hybrid roof systems incorporating conventional built-up roof and polymer-modified bitumen base, interply and cap sheets.

Currently, there are no ASTM International standard material specifications applicable to self-adhering polymer-modified bitumen components for low-slope roof systems. Manufacturers commonly reference ASTM International standard material specifications for conventional APP and SBS polymer-modified sheets or standards for self-adhering polymer-modified bituminous sheet materials used as underlayments in steep-slope systems when describing self-adhering polymer-modified bituminous materials intended for low-slope applications.

Self-adhering polymer-modified bitumen cap sheets are reinforced with fiberglass, polyester or a combination of the two.

Self-adhering polymer-modified bitumen cap sheets generally incorporate a factory-applied granule surfacing though a smooth polymer-modified bitumen surface is available. Smooth-surfaced sheets should be coated or surfaced to protect the polymer-modified bitumen from degradation by ultraviolet radiation and provide a weathering surface. Some manufacturers provide self-adhering end laps with dedicated release films or papers to facilitate joining sheets in the field. Self-adhering polymer-modified bitumen cap sheets generally are used for the finished flashing sheet.

Membrane Flashings: Membrane flashings are used to terminate a polymer-modified bitumen membrane at a roof's perimeter and roof penetrations

Membrane flashings typically consist of a backer layer or layers and a cap sheet. Generally, a component configuration similar to that of the polymer-modified bitumen membrane configuration is used as membrane flashings. For example, if the membrane configuration consists of a polymer-modified bitumen base sheet and a polymer-modified bitumen cap sheet, a flashing base sheet and flashing cap sheet configuration should be used as membrane flashings.

Designers should consult the guidelines for the specific polymer-modified bitumen system being specified for their membrane flashing recommendations.

Liquid-applied Flashings: Liquid-applied flashings also are used to terminate polymer-modified bitumen roof membranes at roof perimeter and roof penetrations. Liquid-applied flashings are one- and two-component moisture-cured resin with low or no solvent content. Some resins require use of a catalyst. Liquid-applied flashings typically consist of a base coat, polyester or fiberglass fabric reinforcement and a top coat. Surfacings, such as a coating or granules, may be applied in some systems.

Liquid-applied flashings commonly are used in situations where penetrations or surfaces are

irregularly shaped and difficult to flash using a membrane flashing.

Consult membrane manufacturer to ensure compatibility between membrane and liquid-applied flashing.

Accessories: Accessory products commonly used when constructing polymer-modified bitumen roof membranes include roof cements, adhesives and asphalt core board.

Bituminous Roof Cements: Bituminous roof cements generally are composed of asphalt that has been thinned, or cut back, with solvents. Bituminous roof cements sometimes are referred to as plastic cement, roofing mastic or roofer's cement. Typically, different grades of roof cements are available for use in horizontal roofing and flashing applications and vertical flashing applications. There are a variety of polymer-modified bitumen roof cements, as well, and some manufacturers of polymer-modified bitumen sheet products require the use of only certain polymer-modified bitumen roof cements with their sheet materials.

Horizontal-grade roof cements are used for embedding metal flashing flanges and forming seals at penetrations, as well as in certain other conditions with some manufacturers' polymer-modified bitumen roof sheets. A horizontal-grade roof cement may contain less filler and more solvent and bitumen with lower softening points than a vertical-grade roof cement, which typically makes the horizontal-grade material more flexible and workable.

Most manufacturers offer winter- and summergrade bituminous roof cements with amounts of solvent contents adjusted to facilitate either cold-weather or warm-weather application. It is important to be aware some bituminous sheet manufacturers require the use of specific types of asphalt roof cements or types of polymer-modified asphalt roof cements with their materials.

NRCA suggests designers and contractors consult polymer-modified bitumen sheet manufacturers for guidelines and recommendations pertaining to the specification and use of bituminous roof cements with polymer-modified bituminous roof sheet products.

Asphalt roof cements should meet or exceed the standards set forth in ASTM D4586, "Standard Specification for Asphalt Roof Cement, Asbestos-Free."

Polymer-modified Bitumen Flashing Adhesives:

Polymer-modified bitumen flashing adhesives generally are composed of asphalt that has been thinned, or cut back, with solvents and blended with polymer modifiers and fillers. Generally, polymer-modified asphalt adhesives should be used in applications with polymer-modified asphalt roof membranes.

Polymer-modified bitumen flashing adhesives typically are produced in two grades: low-viscosity adhesive that may be spread in place using a notched squeegee or sprayed in place, or flashing- or trowelgrade adhesive that has higher viscosity and is better-suited for application to vertical surfaces. The flashing-grade, or high-viscosity, adhesives typically are used to bond membrane flashings to vertical, or steep-slope, substrates. NRCA suggests designers and contractors consult manufacturers of polymermodified bitumen roofing materials for guidelines and recommendations pertaining to the specification and use of polymer-modified bitumen flashing adhesives with polymer-modified bitumen roof membranes. There currently are no ASTM International standard material specifications for polymermodified bitumen flashing adhesives.

Polymeric Adhesives: Adhesives for bituminous sheet materials may be formulated without the addition of asphalt from many of the same polymers used in polymer-modified asphalt adhesives. These formulations may be one- or two-component adhesives and may be solvent-borne or solvent-free.

NRCA suggests designers and contractors consult manufacturers of polymer-modified bitumen roofing materials for guidelines and recommendations pertaining to the specification and use of polymeric adhesives with polymer-modified bitumen roof membranes. There currently are no ASTM In-

ternational standard material specifications for polymeric adhesives intended for use with polymermodified bitumen roof membranes.

Asphalt Core Board: Asphaltic substrate boards—commonly referred to as asphalt core boards—provide a compatible substrate for the application of polymer-modified bitumen roof membranes and membrane flashings. Asphalt core boards may be installed over structural substrates, rigid board insulation and existing roof membranes to provide substrates for torch-applied, hot-mopped, coldadhesive applied and self-adhering asphalt-based membranes. Once the adhesive cures or cools to ambient temperature, the asphalt core boards become fused with the membrane.

Asphalt core boards used in roofing are semi-rigid, multi-ply panels constructed of a core of water-insoluble mineral filler with bituminous binder sandwiched between two reinforcing facings. The panel core commonly is composed of crushed limestone and air-blown asphalt binder or modified asphalt binder. The reinforcing facings typically are fiberglass mats. Manufacturers' product literature should be consulted for product-specific information.

CSA A123.25, "Asphalt core boards used in roofing," is the Canadian product standard for asphalt core board. CSA A123.25 addresses asphalt core boards installed horizontally and vertically as substrates to receive asphalt-based roof membranes and membrane flashings. The standard specifically states it does not address requirements for using asphalt core boards for protecting substrates and carrying the loads associated with vertical flashings without additional support. CSA A123.25 provides requirements for product physical properties such as dimensions, dimensional stability, tensile strength and asphalt content.

Currently, there is no U.S. standard material specification for asphalt core board materials intended for roof system applications.

Asphalt core board for roof system applications typically is available as 4- by 4-foot, 4- by 5-foot and

4- by 8-foot panels that are $\frac{1}{8}$ of an inch, $\frac{3}{16}$ of an inch, $\frac{1}{4}$ of an inch or $\frac{1}{2}$ of an inch in thickness. Other panel sizes and thicknesses may be available, depending on manufacturer.

Composite asphaltic substrate board panels constructed of plastic foam insulation laminated to asphalt core board and asphaltic base sheet laminated to asphalt core board also are available. These products are intended as one-step-application replacements for components that otherwise would be installed separately. CSA A123.25 does not address composite asphalt substrate board panels.

Securement methods for asphalt core board depend on the substrate and roof membrane specified. Asphalt core boards may be mechanically attached, or adhered in compatible cold-applied adhesive or hot-applied asphalt to suitable structural substrates, rigid board insulation and existing roof membranes. Asphalt core board for roof system applications generally is considered fire-resistant. Asphalt core board can be exposed directly to hot bitumen and roofing torch flame.

Roof system manufacturers should be consulted for additional information regarding recommended securement procedures.

Application of Polymer-modified Bitumen Membrane Materials: A complete polymer-modified bitumen membrane roof system may include a slip sheet; air or vapor retarder; rigid board roof insulation; cover board; bitumen or adhesive; a base sheet or interply sheets; a polymer-modified bitumen cap sheet; and roof surfacing.

Available methods for adhered application of polymer-modified bitumen sheet products depend on the primary polymer modifier type and specific product configuration. APP polymer-modified asphalt sheets may be torch-applied or cold adhesive-applied. Some APP polymer-modified asphalt sheet products designed for self-adhering application also are available. SBS polymer-modified asphalt sheets may be applied in hot-mopped asphalt or hot-mopped SEBS-modified asphalt, or they may be torch-applied

or cold-adhesive applied. SBS polymer-modified asphalt sheet products designed for self-adhering application also are available.

The specific polymer-modified sheet application method(s) commonly are determined by project specifications. In other scenarios, the application method(s) selection commonly is guided by considerations such as job-site conditions, local code requirements or other regulations, or owner or owner representative preferences.

A base sheet or interply sheets should be used as the first layer over nonnailable (concrete), nailable and insulated substrates. The designer should specify the base sheet or type and, if applicable, number of plies of the interply sheets intended and its method of attachment or adhesion.

The polymer-modified bitumen cap sheet layer should be installed over the base sheet or interply sheets in installation operations separate from the installation of the base sheet or base interply sheets.

In cold-process applications, laps may be adhered or heat welded, depending on specific system and/ or site conditions. Adhered laps are not watertight until the adhesive cures. When solvent-based adhesives are used for APP polymer-modified bitumen membrane construction, heat-welded laps may inhibit solvent flash-off. Installers should closely follow manufacturer instructions for adhering laps. Depending on system and/or site conditions, the manufacturer may require laps be heat welded.

Granule-surfaced cap sheets are designed to be exposed without the need for an additional surfacing application. Installation of liquid-applied coatings or an aggregate surfacing often is used over smooth-surfaced cap sheets. Additional information about liquid-applied coatings and aggregate surfacing applications is provided in Chapter 7—Surfacings.

Fasteners for Polymer-modified Bitumen Membranes: Large-head, annular-threaded nails, barbed, ring-shank nails or specifically approved mechanical fasteners should be used to fasten

polymer-modified bitumen membranes and asphalt core board to nailable decks, for back-nailing and to fasten base flashings in polymer-modified bitumen roof systems. For additional information regarding fasteners used with polymer-modified bitumen membranes, refer to Section 6.1—Base Sheet Fasteners.

Bitumen Heating: When SBS polymer-modified bitumen membrane materials are specified to be installed in hot bitumen, the EVT range recommendation generally is not applicable. Bitumen should be hot enough to promote thorough adhesion and lamination of the plies; this usually requires bitumen be applied at a temperature greater than the EVT. Bitumen should not be heated above a temperature that is 550 F maximum.

Cold-applied Adhesive Storage, Handling and Application: Cold-applied polymer-modified bitumen membrane adhesives are particularly temperature-sensitive, and, consequently, site conditions may restrict cold-process polymer-modified bitumen membrane construction to a greater extent compared with hot-applied polymer-modified bitumen membrane construction. The following should be considered with regard to temperature sensitivity of cold-process polymer-modified bitumen membrane materials:

- Solvent-based cold-applied adhesives may contain combustible or flammable solvents and require safe storage and handling practices. Manufacturers should be consulted for applicable recommendations.
- Manufacturers commonly indicate specific material temperature ranges and minimum ambient and substrate temperatures for adhesive application. Equipment suitable for preheating and controlling material temperature may be required for application.
- Application rates are dependent on adhesive temperature at the point of application and substrate type.
- Flash-off times, open times and cure times are product-specific and temperaturedependent.

 Manufacturer recommendations of site conditions suitable for cold-process builtup roof membrane applications may make it impractical to install these materials during extremely cold weather or wet seasons.

Torch-applied Application: Torch-applied polymer-modified bitumen products have been used safely in the U.S. since the late 1970s; however, in a limited number of situations, rooftop fires have occurred during application of these products.

NRCA is concerned with fire safety and prevention during the application of torch-applied polymer-modified bitumen sheet products. The potential for fire is of specific concern during the installation of torch-applied membrane sheets over combustible substrates, such as wood roof decks and wood blocking, wood panel sheathing, wood planks or boards. Another area of concern is the torch application of flashings because of the potential for air gaps between the wall and deck and the potential for incidental contact with multiple adjacent construction materials.

NRCA believes torch-applied polymer-modified bitumen products can be safely used if the roof deck, roof membrane and construction details are properly designed and installed with fire safety techniques taken into consideration. NRCA recommends the design of torch-applied polymer-modified bitumen membrane roof systems follow the guidelines provided in Chapter 1—Roof Assembly Configurations.

NRCA recommends the application of torch-applied polymer-modified bitumen sheet products follow the CERTA roofing torch safety program guidelines. Additional information about CERTA is provided in Chapter 10—Construction Details.

NRCA recommends against specifying torchapplied polymer-modified bitumen membranes over combustible substrate roof decks, even where a thermal barrier insulation layer has been laid over the combustible roof deck. NRCA considers the potential fire risk associated with torch-applied application over combustible roof decks to outweigh any advantages torch application provides. Also, alternative application methods are available and

have proved successful. Designers should consider alternative application methods, such as cold-adhesive application, where polymer-modified bitumen roof membranes are being specified over combustible roof decks.

Membrane Application: Polymer-modified bituminous roll materials should be laid as continuously as possible. It is important wood nailers, curbs, drains and other penetrations be in place before roofing work begins. Irregularities, such as fishmouths, should be cut and patched before applying the next sequential ply. Buckles, ridges and blisters should be repaired before applying surfacing.

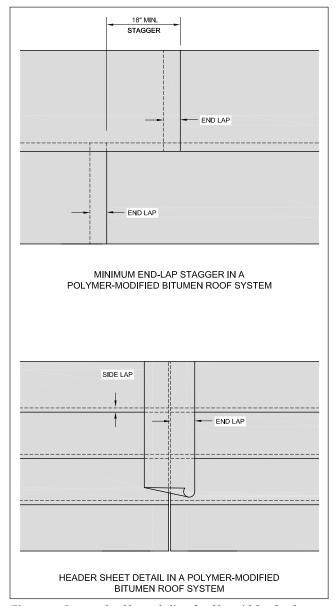
On lower-sloped roofs, roof membrane plies should be applied so the flow of water runoff will not be against the laps. When possible, all plies should be installed in shingle fashion. Some membrane manufacturers establish specific slope guidelines and limitations for their polymer-modified bitumen membranes. When the slope is greater than 2:12, consideration should be given to laying the plies parallel to the slope; this application method is referred to as "strapping the plies" and also may be used on slopes less than 2:12.

Some manufacturers of polymer-modified bitumen membrane materials suggest phased application of surfacing sheets and other membrane materials. Blistering may occur if the surface of a base sheet/membrane becomes contaminated before application of the cap/surfacing sheet. Therefore, NRCA suggests membrane manufacturers' literature be reviewed for guidelines and recommendations regarding membrane application.

Before they are installed, polymer-modified bitumen sheets should be unrolled; cut into workable lengths; and allowed to lie flat, which reduces roll memory.

Polymer-modified bitumen cap sheets generally are applied in a staggered end-lap configuration method or with aligned end laps with a header sheet method. Illustrations of these two cap sheet application methods are provided in Figure 5-3.

Some manufacturers of polymer-modified bitumen roll materials recommend applying pressure by



 $Figure \ 5-3: Staggered\ end\ lap\ and\ aligned\ end\ lap\ with\ header\ sheet\ installation\ methods$

using a weighted roller or foot to side- and end-lap seams and T-joints during application of their membrane materials. With cold-process applications, manufacturers commonly recommend applying pressure to the body of sheets with a weighted roller, broom or other tool as a means of removing air pockets and promoting complete adhesive contact with the sheets. See Figure 5-4 pn page 214.

Blisters have been reported in some SBS polymermodified bitumen membrane systems. Most have involved installation with hot asphalt and occurred

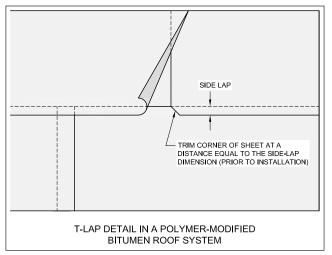


Figure 5-4: Example of a T-joint

between the cap sheet and base sheet or ply sheets. Application factors that can contribute to blistering include insufficient asphalt temperature at the point of application, long mop lead and lack of cap sheet embedment into the asphalt mopping. Mopping asphalt needs to be hot enough to obtain fusion with the modified sheet. Mop lead is a critical factor because if it is too long, the asphalt may become too cool to adequately bond to the SBS sheet when contact is made. Some manufacturers recommend applying pressure to the cap sheet immediately after application using a broom or weighted roller to help achieve proper embedment of the cap sheet.

An effort should be made to limit traffic over recently installed polymer-modified bitumen sheets to minimize displacement of hot bitumen and damage to sheets until the bitumen has cooled and set.

When polymer-modified bitumen sheets are installed with solvent-release adhesives, traffic over recently installed sheets should be limited, particularly at lap areas, until the adhesive has had sufficient time to cure, as recommended by the manufacturer.

Self-adhering sheet packaging is designed to protect a roll from UV radiation and the roll ends from damage. Exposure to UV radiation can affect the adhesive properties, and damaged ends can affect side-lap integrity. Rolls should not be removed from packaging until they are ready to install.

Self-adhering sheets are sensitive to moisture, dust, dirt or foreign matter that could hinder proper adhesion. Manufacturers' guidelines for substrate preparation (e.g., cleaning, priming) should be followed.

Adhesive bond strength between self-adhering sheets and their substrates depends on temperatures of the ambient air, substrate and the sheet. The self-adhering membrane manufacturer's guidelines for minimum and maximum temperatures should be followed.

Manufacturers' guidelines for using hot-air equipment to augment the bonding of self-adhering polymer-modified bitumen material to itself or a substrate when installation temperature is near the minimum recommended range should be followed.

Pressure should be applied to the sheets, particularly to the surface of seams and T-joints, to promote complete adhesion. This typically is accomplished by using a weighted roller.

Construction-site traffic from all trades should be limited to designated areas and walkways. Completed roof membranes are not suitable as work platforms or staging areas for other trades. If construction traffic is anticipated or inevitable, the use of a temporary roof can act as a sacrificial traffic surface, allowing for construction traffic and abuse until the primary waterproofing membrane is installed. See Appendix 3—Temporary Roof Systems for additional information.

Designers also have the option of consulting the roof system manufacturer's literature for additional application guidelines and recommendations.

Chapter 1—Roof System Configurations in this manual contains additional information regarding installing polymer-modified bitumen membrane roof systems.

Membrane Flashing Application: Membrane flashing configurations for common construction detail conditions are depicted in Chapter 10—Construction Details. Construction details specific to polymer-modified bitumen roof membranes are

denoted as "MB-" followed by a number and possibly a letter (e.g., MB-1, MB-2, MB-3).

The manufacturer of the specific polymer-modified bitumen membrane roof system being installed should be consulted for its specific recommendations for membrane flashing materials and application.

For torch-applied, polymer-modified bitumen membrane flashings, NRCA recommends the design and application of membrane flashing be done in accordance with the CERTA roofing torch safety program. Additional information regarding CERTA is provided in Chapter 10—Construction Details.

Surfacing Application: Applying surfacing at a time interval other than when the membrane is applied is not considered by NRCA to be a phased application.

Other membrane surfacing options for APP polymer-modified asphalt sheet installations include a flood coat of hot bitumen and aggregate or liquid-applied coatings. Additional information regarding these membrane surfacing options is provided in Chapter 7—Surfacings and Appendix 5—Building Code Compliance for Membrane Roof Assemblies.

Additional Information: NRCA suggests consulting the membrane manufacturer's literature for additional application guidelines and recommendations.

Guidelines for quality control and quality assurance during the application of polymer-modified bitumen membrane roof systems is provided in NRCA's Quality Control and Quality-assurance Guidelines for the Application of Membrane Roof Systems.

Chapter 1—Roof System Configurations in this manual contains additional information about installing polymer-modified bitumen membrane roof systems.

5.4—Single-ply Roof Membranes

In addition to the information in this section, information contained in Section 5.1—Guidelines Appli-

cable to All Membrane Types also applies to singleply roof membranes.

Single-ply roof membranes are a category of roof membranes that are field-applied using just one layer of membrane material, either homogeneous or composite, rather than multiple layers.

There are two principal types of materials used in the construction of single-ply roof membranes: thermoset polymer sheets and thermoplastic polymer sheets. The terms describe the materials' different behaviors regarding heating that arise from their different molecular arrangements and chemical properties.

For thermoset roof membranes, the materials' principal polymers are chemically cross-linked. This chemical cross-linking of thermoset membranes means once the sheet material is cured or vulcanized, it cannot be softened to bond with itself and cannot be reshaped.

Thermoset materials used in construction of singleply membranes, such as ethylene propylene diene terpolymer, are manufactured as cured or vulcanized sheets or as partially cured sheets intended to fully cure on the roof. Unlike thermoplastic materials, once fully cured, thermoset polymers only can be bonded to like material with a liquid-applied adhesive (glue) or adhesive seam tape because new molecular linkages may not be formed.

Currently, EPDM sheets are the only thermoset materials commonly used in construction of single-ply roof membranes in the North American market.

Other thermoset single-ply roof membrane materials that have been used historically include chlorosulfonated polyethylene and polyisobutylene. Refer to *The NRCA Roofing Manual: Membrane Roof Systems—2015* or earlier editions for additional information about CSPE and PIB single-ply roof membrane materials.

With thermoplastic single-ply membranes, the materials' chemical and physical characteristics allow them to repeatedly soften when heated and harden when cooled. Typically, there is no chemical cross-linking in the molecular composition of a

CHAPTER 10 CONSTRUCTION DETAILS

The NRCA Roofing Manual: Membrane Roof Systems—2023

Chapter 10—Construction Details provides technical information concerning the design and installation of construction details for quality membrane roof systems. This introduction is intended to supplement the notes on the individual construction details.

In this chapter, construction details are provided for the following membrane roof system types:

- Built-up membrane
- Polymer-modified bitumen membrane
- EPDM membrane
- Thermoplastic membrane
- Liquid-applied membrane

Construction details applicable to built-up membrane roof systems are denoted as "BUR-" followed by a number and possibly a letter (e.g., BUR-1, BUR-1A).

Construction details applicable to polymer-modified bitumen roof systems are denoted as "MB-" followed by a number and possibly a letter (e.g., MB-1, MB-1A).

Construction details applicable to EPDM single-ply membrane roof systems are denoted as "EPDM-" followed by a number and possibly a letter (e.g., EPDM-1, EPDM-1A).

Construction details applicable to thermoplastic membrane roof system types are denoted as "TP-" followed by a number and possibly a letter (e.g., TP-1, TP-1A).

Construction details applicable to liquid-applied membrane roof system types are denoted as "LA-" followed by a number and possibly a letter (e.g., LA-1, LA-1A).

Generally, the number after the membrane system type denotation identifies similar detail conditions between the various roof membrane types. For example, Construction Details BUR-1, MB-1, EPDM-1, TP-1 and LA-1 illustrate NRCA's recommended membrane flashing treatment of similar parapet wall conditions with a metal coping.

The letter designation after a membrane system type designation and number identifies NRCA's order of preference for addressing a specific detail condition. For example, Construction Detail EPDM-8—Base Flashing at Expansion Joint With Metal Cover depicts NRCA's preferred method of addressing an expansion joint detail for EPDM membrane roof systems. Construction Detail EPDM-8A—Base Flashing at Expansion Joint (Nonreinforced EPDM Membranes) and Construction Detail EPDM-8B—Expansion Joint for Loose-laid, Ballasted Systems (Nonreinforced EPDM Membranes) depict alternative details NRCA also considers acceptable subject to any limitations described in the notes on these construction details.

The construction detail designations for built-up membranes and polymer-modified bitumen membranes may also include parenthetical designations "(HC)" or "(T)." The designation "(HC)" denotes a construction detail applicable to hot- or cold-applied applications only. The designation "(T)" denotes a construction detail applicable to torch-applied applications only. Construction details for built-up or polymer-modified bitumen membranes that do not have a designation "(HC)" or "(T)" are applicable to hot-, cold- and torch-applied applications.

10.1—Information Applicable to All Construction Details

The construction details in this manual provide a generic concept for each specific detail type shown. NRCA's construction details likely will require modification to meet a project's specific requirements. It is a designer's responsibility to adapt the construction details to a project's requirements.

The information contained in this manual is intended to primarily address construction details applicable to new construction. When considering reroof-

ing projects, Chapter 9—Reroofing should be consulted regarding the decision to re-cover or remove existing roof systems and for general information applicable to reroofing low-slope roof systems. Once this decision is made, most information contained within this chapter also can apply to reroofing.

NRCA suggests this chapter be used in the design of roof systems only after various criteria have been carefully considered, including:

- · Climate and geographic location
- A building's intended use and design life expectancy
- Exterior and interior temperature and humidity conditions
- Code requirements
- · Type of roof deck
- Slope and drainage
- A roof's configuration
- Building movement
- Fire, wind and impact resistance
- Type and amount of insulation needed
- · Need for ventilation
- · Maintenance, repair and reroofing
- Compatibility with adjacent components, including potential material discharge onto a roof
- Construction sequencing
- Worker safety
- Potential building additions
- Odors, noise and dust generated by certain system application methods
- Rooftop traffic
- · Reflectivity or emissivity
- Environmental impact

These criteria play important roles in the success or failure of every roof assembly and must be considered by a designer to determine the appropriate components of a roof assembly, applicable specifications and construction details to be used.

In addition, NRCA recommends designers consider the following factors for membrane roof systems.

Other Components: Components that may be provided or installed by other trades that are integrated into roof systems can be critical to the watertight integrity of completed roof systems. These components may include:

- Metal counterflashings at curbs and other penetrations
- Lead flashings and drains and plumbing vent stacks
- Drain heads/clamps/strainers
- Sheet-metal vents
- Sheet-metal pitch pans
- · Through-wall flashings
- Skylight components and flashings
- Smoke hatch components and flashings
- Expansion joints and related components
- · Wood blocking and attachment
- Pipe or conduit supports
- · Crickets and saddles
- · Siding or cladding
- Chimney caps
- Wall cladding
- Permanent safety anchors or guardrails
- Microwave or satellite dish components
- Lightning protection arresters and cables
- Photovoltaic systems

Definition of responsibility for the above components should be determined before job initiation.

Roof Assembly Components—Deck, Insulation and Membrane: In all the construction details, unless otherwise noted, the primary compo-

nents of each construction detail are illustrated as generic components.

In addition, NRCA recommends designers consider the following:

- Rigid board roof insulation depicted in the details is generic and represents primary insulation and a protective top layer. The primary insulation may consist of two or more layers of flat stock insulation with joints staggered between layers by a minimum of 6 inches or tapered insulation system composed of one or a combination of the materials described in Chapter 4— Rigid Board Insulation. The top layer of an insulation system should be an appropriate cover board.
- Some single-ply membranes, such as PVC membranes, may require a slip sheet beneath the membrane when installed over some insulation or substrates. Such slip sheets are not depicted in the construction details for clarity. Membrane system manufacturers should be consulted for specific recommendations regarding slip sheets.

NRCA makes these construction details available in a computer-aided design format to allow users to customize these construction details using their own CAD software application to suit their specific project needs.

Wood Nailers and Blocking: Many of the construction details illustrated in this manual depict wood nailers and blocking at roof edges and other points of roof termination. Wood nailers must be adequately fastened to the substrate below to resist uplift loads. This especially is true at parapet walls/copings and roof edges where edge-metal shapes are fastened to wood blocking.

Among other advantages, the nailers provide protection for the edges of rigid board insulation and provide a substrate for anchoring flashing materials. Wood nailers should be a minimum of 2- by 6-inch nominal-dimension lumber. To provide an adequate base, nailers should be securely attached to a roof

deck, wall and/or structural framing. In the design of specific details for a project, a designer should describe and clearly indicate the manner in which wood nailers and/or blocking should be incorporated into construction details. A designer should specify the means of attachment, as well as the fastening schedule for all wood nailers and blocking.

Preservative-treated Wood: The 2012 editions of the International Building Code and International Residential Code and later editions, require preservative-treated wood to comply with AWPA Standard U1. ACQ and CA wood treatments are included in the American Wood Protection Association Standard U1, "Use Category System: User Specification for Treated Wood." Labels indicating wood treated with preservatives that comply with AWPA Standard U1 requirements contain the "AWPA U1" or "AWPA" designation, producer identification, preservative treatment designation, preservative retention level and the AWPA Use Category. AWPA Use Categories appropriate for wood used in exterior construction, not in contact with the ground, are UC3A for coated wood and UC3B for uncoated wood or higher designations in accordance with AWPA's Use Category System.

To date, MCA, MCQ and μCA wood treatments have not been standardized by AWPA and therefore should be considered proprietary to each manufacturer. Manufacturers possess evaluation reports by ICC Evaluation Service, which may be used to substantiate code compliance to the code authority having jurisdiction. Labels found on MCA-, MCQ- and μCA -treated wood contain the ICC-ES evaluation report number and a general description of the intended application, such as Ground Contact and Above Ground Use.

NRCA suggests the following guidelines when encountering currently available preservative-treated wood:

 Hot-dipped galvanized fasteners complying with ASTM A153 and connectors complying with ASTM A653, Class G185, generally are acceptable. Type 304 or Type 316 stainless-steel fasteners and connectors

- are recommended for maximum corrosion resistance. Carbon steel, aluminum and electroplated galvanized steel fasteners and connectors should not be used in contact with preservative-treated wood.
- Fasteners with proprietary anti-corrosion coatings may be acceptable for use with preservative-treated wood. When considering the use of such proprietary coated fasteners and connectors, fastener manufacturers can be consulted for specific information regarding the performance of their products in preservative-treated wood and any precautions or special instructions that may be applicable.
- Aluminum fasteners, flashings and accessory products should not be used in direct contact with any preservative-treated wood. ACQ-treated wood is not compatible with aluminum.
- Uncoated metal and painted metal flashings and accessories, except for 300-series stainless steel, should not be used in direct contact with preservative-treated wood containing copper-based preservatives.
 Metal products, except stainless steel, may be used if separated from preservative-treated wood by a spacer or barrier, such as a single-ply membrane or selfadhering polymer-modified bitumen membrane.

NRCA is of the opinion the corrosion-related concerns regarding the use of currently available preservative-treated wood possibly outweigh the benefits that preservative-treated wood provides as a component in roof assemblies. In many instances, nontreated, construction-grade wood is suitable for use in roof assemblies as blocking or nailers provided reasonable measures are taken to ensure the nontreated wood remains reasonably dry when in service. Where a specific design provides for a secondary means of waterproofing, NRCA considers the use of nontreated, construction-grade wood to be an acceptable substitute for treated wood.

Job-site-fabricated Components: A majority of the construction details illustrated in this manual depict job-site-fabricated construction. Many roof system manufacturers offer prefabricated flashing components or have guidelines that permit the use of materials other than those indicated in these details. Flashing materials may vary greatly; individual manufacturer's requirements should be examined and evaluated for construction compatibility.

Penetrations and Clearance: Roof drains, penetration pockets and vertical sides of curbs often have particular installation or attachment requirements, which follow:

- Interior roof drain bowls and under-deck clamps typically are furnished and installed by others. Clamping rings and dome strainers generally are furnished by others and installed by a roofing contractor.
- Prefabricated flashing, metal sleeves and curbs with pre-molded pipe flashings are preferred for sealing pipes or irregularly shaped support legs. Penetration pockets or pitch pans are acceptable as a last alternative. Pourable sealer is the recommended top fill material for penetration pockets. Polymer-modified bitumen roofing cement may be acceptable as a top fill material for penetration pockets in bituminous roof systems.
- Vertical wood curb nailers may be secured to a structural member or the roof deck using additional wood blocking, metal angle supports, or a combination of wood and metal. Curbs may consist of prefabricated (insulated where appropriate) metal curbs and, when securing flashing is necessary, should have nailers at the top edge.

The maximum amount of space should be provided between pipes, walls and curbs to facilitate proper installation of membranes and flashings. NRCA recommends a minimum of 12 inches of clearance between pipes, a minimum of 12 inches of clearance between pipes and curbs or walls, and a minimum

of 24 inches of clearance between walls and curbs. Membrane roof systems have different installation methods that may require different spacings, and certain project conditions may not allow these recommended clearances. However, adequate space (i.e., clearance) is required for a mechanic to properly install the required flashings at these locations. See Figure 10-1 on page 310.

Structural supports that penetrate vertically through the roof membrane preferably should be square or round. H-, L- and T-shaped structural supports are not preferred because they are difficult to flash properly and may be a constant maintenance problem.

Fastener Spacing: Fastener spacing for gasketed fasteners depicted in the construction details generally is between 8 inches and 24 inches. Fastener spacings provided in the details are nominal dimensions.

Metal Flashing Components: Because metals have thermal expansion and contraction characteristics that differ from most other roof covering materials, it is advisable to isolate metal flashings from the primary roof covering and flashing when possible. Embedding or sandwiching metal flashing flanges into a roof membrane or membrane flashing may fatigue the membrane materials and eventually cause splits, tears or cracks in the membrane as a result of differential movement. NRCA suggests avoiding, where possible, flashing details that require rigid metal flanges to be embedded or sandwiched into roof membranes.

Illustrations of metal component joinery, such as concealed or cover plates, are located in the Architectural Metal Flashing section (Details SM-) of The NRCA Roofing Manual: Architectural Metal Flashing and Condensation and Air Leakage Control. NRCA does not recommend caulking the joint between the bottom of the exterior vertical face of a coping cap or metal edge flashing and building exterior because it does not add to the waterproofing integrity of the assembly and may, in fact, hinder the ability of the wall construction to dissipate moisture. Proper gauge, girth and continuous cleat

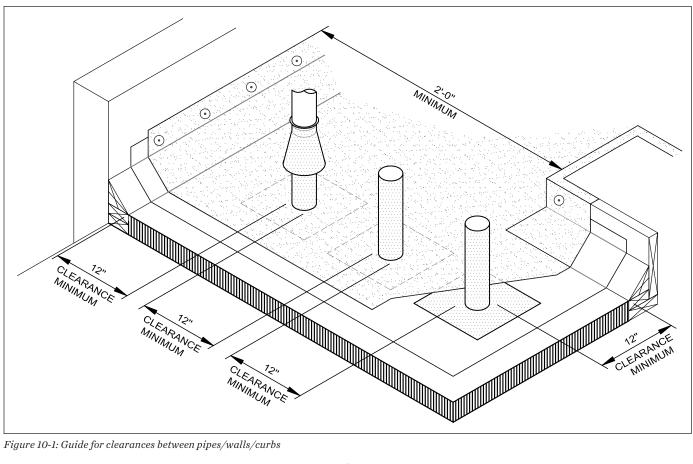


Figure 10-1: Guide for clearances between pipes/walls/curbs

fastening should minimize wind-uplift damage. The bottom of the exterior vertical face of a coping cap or metal edge flashing should be a minimum of 1 inch below the uppermost edge of the exterior wall material.

Parapet Walls and Roof Decks: Parapet walls and deck/wall intersections often require specific additional components to accommodate vertical flashings or coping caps. These items can take numerous forms and be made of various materials.

- · Tapered, continuous, rigid shims for the top of parapet walls provide positive slope for drainage and may be composed of wood, insulation, metal or other compatible material.
- Tapered cants at bases of walls include preservative-treated wood, perlite, fiberboard or appropriate poured-in-place material.
- Flashing substrate materials on vertical walls and backsides of parapets may include brick or concrete masonry, precast or

poured-in-place concrete, wood and gypsum board.

- Through-wall flashing materials, weepholes and masonry caulking typically are furnished and installed by masonry contractors. Sheet-metal receivers may be furnished by a sheet metal contractor and installed by masonry and wall cladding contractors.
- Before installing metal caps, parapet walls need to be covered by a sheet membrane liner.
- Concrete, masonry, metal and gypsum board walls should be primed in preparation for low-slope membrane flashings.

BUR/MB Membrane Flashing and Stripping

Plies: The type of membrane system, substrate and surfacing method usually dictates the number, type and method of attachment for backer plies, flashing sheets and stripping plies.

- Specific configurations of backer plies and/ or membrane flashing may vary with the individual roof system. Installation of membrane flashing may entail lacing field and flashing plies for a polymer-modified bitumen system. Roof system manufacturers' specific requirements should be consulted for membrane flashing.
- A recommended maximum membrane flashing height may no longer be applicable for certain roof membrane types. Polymer-modified bitumen sheets applied in a strapped configuration are acceptable for vertical installations. However, it is suggested a separator consisting of a counterflashing or cladding be installed to separate the roof flashing from the wall covering.
- Mineral-surfaced polymer-modified membrane sheets should be degranulated (heated with granules pressed into the membrane bitumen) at tie-ins of end laps, flashing base laps or stripping ply overlaps.
- Stripping plies for built-up and polymermodified bitumen systems may consist of two plies of ply sheet, one ply of field ply sheet, and one ply of polymer-modified bitumen sheet or one layer of heavyweight reinforced polymer-modified bitumen sheet.

Torch-applied Polymer-modified Flashing:

NRCA is concerned with fire safety and prevention during the application of torch-applied polymer-modified bitumen sheet products. Torch-applied polymer-modified bitumen products have been used safely in the U.S. since the late 1970s; however, in a limited number of situations, roof-top fires have occurred during application of these products. The potential for fire is of specific concern during the installation of torch-applied membrane flashing sheets over combustible substrates, such as wood roof decks and wood blocking, wood panel sheathing, wood planks or boards flashing substrates.

NRCA is of the opinion torch-applied polymermodified bitumen products can be safely used, even over combustible flashing substrates if the roof membrane and construction details are properly designed and installed with fire safety techniques taken into consideration.

A number of construction details in this chapter are applicable to common construction details conditions where torch-applied polymer-modified bitumen membrane products may be used as membrane flashings. Construction details such as BUR-2, BUR-3, MB-2 and MB-3—that is, those BUR- and MB- construction details without a "(T)" designation—can be applicable to torch-applied polymer-modified bitumen membrane flashings over noncombustible substrates.

Noncombustible Substrate: When using torch-applied polymer-modified bitumen membrane flashings over noncombustible substrates, NRCA recommends use of noncombustible cant strips. Lumber and wood fiberboard cant strips generally are not considered to be noncombustible. NRCA suggests the use of noncombustible perlite, stone wool or other similar noncombustible material for cant strips. Furthermore, NRCA recommends extending the membrane field plies or sheets up onto the vertical surface of the flashing substrate beyond the top of the cant strip to provide a seal.

Over noncombustible substrates, NRCA recommends a flashing backer consisting of a minimum of one layer of ply sheet, base sheet or polymer-modified base sheet be adhered to the substrate using hot asphalt. As an alternative, one layer of a self-adhering, smooth-surfaced polymer-modified bitumen sheet may be used as a flashing backer. The flashing backer should extend onto the roof surface a minimum of 2 inches beyond the cant strip and extend vertically upward to the height of the finished membrane where flashing will be applied.

For noncombustible substrates with properly configured flashing backers, NRCA considers torchapplied application of polymer-modified membrane flashings by the direct torching method to be appropriate.

The following construction details for built-up and polymer-modified bitumen membranes depict membrane flashing configurations over noncombustible flashing substrates NRCA considers appropriate.

BUR-2—Raised Perimeter Edge With Metal Flashing [Fascia Cap] (Hot-, Cold- or Torch-applied Flashing Systems)

BUR-3—Embedded Edge-metal Flashing [Gravel Stop] (Hot-, Cold- or Torch-applied Flashing Systems)

BUR-4—Base Flashing With Surface-mounted Counterflashing at Concrete Wall (Hot-, Cold- or Torch-applied Flashing Systems)

BUR-5—Base Flashing With Two-piece Sheetmetal Counterflashing (Hot-, Cold- or Torchapplied Flashing Systems)

BUR-6—Base Flashing With Vented Base Sheet (Hot-, Cold- or Torch-applied Flashing Systems)

BUR-11—Equipment Support Stand and Typical Rain Collar Penetration (Hot-, Cold- or Torchapplied Flashing Systems)

BUR-12—Base Flashing at Prefabricated Metal Curb (Hot-, Cold- or Torch-applied Flashing Systems)

BUR-16—Base Flashing at Sheet-metal Hood for Piping Through Roof Deck (Hot-, Cold- or Torch-applied Flashing Systems)

BUR-18—Sheet-metal Stack Vent [Hot or Cold] (Hot-, Cold- or Torch-applied Flashing Systems)

BUR-19—Plumbing Vent (Hot-, Cold- or Torchapplied Flashing Systems)

BUR-20A—Penetration Pocket—Single Penetration (Hot-, Cold- or Torch-applied Flashing Systems)

BUR-21—Penetration Pocket—Double Penetration (Hot-, Cold- or Torch-applied Flashing Systems)

BUR-22—Pipe Support Curb (Hot-, Cold- or Torch-applied Flashing Systems)

BUR-22A—Pipe Support (Hot-, Cold- or Torchapplied Flashing Systems)

BUR-23—Cable Penetration (Hot-, Cold- or Torch-applied Flashing Systems)

BUR-24—Lightning Protection Terminal (Hot-, Cold- or Torch-applied Flashing Systems)

BUR-25—Roof Drain (Hot-, Cold- or Torch-applied Flashing Systems)

BUR-26—Roof Drain with Extension and Temporary Roof System (Hot-, Cold- or Torch-applied Flashing Systems)

BUR-27—Through-wall Scupper (Hot-, Cold- or Torch-applied Flashing Systems)

BUR-28—Overflow Scupper (Hot-, Cold- or Torch-applied Flashing Systems)

BUR-29—Gutter With Perimeter Edge Metal (Hot-, Cold- or Torch-applied Flashing Systems)

MB-2—Raised Perimeter Edge With Metal Flashing [Fascia Cap] (Hot-, Cold- or Torch-applied Flashing Systems)

MB-3—Embedded Edge-metal Flashing [Gravel Stop] (Hot-, Cold- or Torch-applied Flashing Systems)

MB-3A—Embedded Edge-metal Flashing [Gravel Stop] (Hot-, Cold- or Torch-applied Flashing Systems)

MB-4—Base Flashing With Surface-mounted Counterflashing at Concrete Wall (Hot-, Cold- or Torch-applied Flashing Systems)

MB-5—Base Flashing With Two-piece Sheetmetal Counterflashing (Hot-, Cold- or Torchapplied Flashing Systems)

MB-6—Base Flashing With Vented Base Sheet (Hot-, Cold- or Torch-applied Flashing Systems)

MB-11—Equipment Support Stand and Typical Rain Collar Penetration (Hot-, Cold- or Torch-applied Flashing Systems)

MB-11A—Equipment Support Stand and Typical Rain Collar Penetration (Hot-, Cold- or Torchapplied Flashing Systems)

MB-12—Base Flashing at Prefabricated Metal Curb (Hot-, Cold- or Torch-applied Flashing Systems)

MB-16—Base Flashing at Sheet-metal Hood for Piping Through Roof Deck (Hot-, Cold- or Torch-applied Flashing Systems)

MB-16A—Base Flashing at Sheet-metal Hood for Piping Through Roof Deck (Hot-, Cold- or Torch-applied Flashing Systems)

MB-18—Sheet-metal Stack Vent [Hot or Cold] (Hot-, Cold- or Torch-applied Flashing Systems)

MB-18A—Sheet-metal Stack Vent [Hot or Cold] (Hot-, Cold- or Torch-applied Flashing Systems)

MB-19—Plumbing Vent (Hot-, Cold- or Torchapplied Flashing Systems)

MB-19A—Plumbing Vent (Hot-, Cold- or Torchapplied Flashing Systems)

MB-20A—Penetration Pocket—Single Penetration (Hot-, Cold- or Torch-applied Flashing Systems)

MB-20B—Penetration Pocket—Single Penetration (Hot-, Cold- or Torch-applied Flashing Systems)

MB-21—Penetration Pocket—Double Penetration (Hot-, Cold- or Torch-applied Flashing Systems)

MB-21A—Penetration Pocket—Double Penetration (Hot-, Cold- or Torch-applied Flashing Systems)

MB-22—Pipe Support Curb (Hot-, Cold- or Torch-applied Flashing Systems)

MB-22A—Pipe Support (Hot-, Cold- or Torchapplied Flashing Systems)

MB-23—Cable Penetration (Hot-, Cold- or Torch-applied Flashing Systems)

MB-23A—Cable Penetration (Hot-, Cold- or Torch-applied Flashing Systems)

MB-24—Lightning Protection Terminal (Hot-, Cold- or Torch-applied Flashing Systems

MB-25—Roof Drain (Hot-, Cold- or Torch-applied Flashing Systems)

MB-25A—Roof Drain (Hot-, Cold- or Torch-applied Flashing Systems)

MB-26—Roof Drain with Extension and Temporary Roof System (Hot-, Cold- or Torch-applied Flashing Systems)

MB-27—Through-wall Scupper (Hot-, Cold- or Torch-applied Flashing Systems)

MB-28—Overflow Scupper (Hot-, Cold- or Torch-applied Flashing Systems)

MB-29—Gutter With Perimeter Edge Metal (Hot-, Cold- or Torch-applied Flashing Systems)

MB-29A—Gutter With Perimeter Edge Metal (Hot-, Cold- or Torch-applied Flashing Systems)

Combustible Substrates: When using torchapplied polymer-modified bitumen membrane flashings over combustible substrates, NRCA recommends use of noncombustible cant strips. Lumber and wood fiberboard cant strips generally are not considered to be noncombustible. NRCA suggests the use of noncombustible perlite, stone wool or other similar noncombustible material for cant strips. Furthermore, NRCA recommends extending the membrane field plies or sheets up onto the vertical surface of the flashing substrate beyond the top of the cant strip to provide a seal.

Over combustible substrates, NRCA recommends using a two-layer flashing backer consisting of one layer of fiberglass ply sheet; fiberglass base sheet or polymer-modified bitumen base sheet fastened to the substrate; and an additional layer of fiberglass ply sheet, fiberglass base sheet or polymer-modified bitumen base sheet adhered to the first layer using hot asphalt. Whether the second layer is a ply sheet or a base sheet, it should be installed with sealed laps.

As an alternative to a two-layer flashing backer, NRCA considers a single-layer of a self-adhering, smooth-surfaced polymer-modified bitumen sheet adhered to the substrate with sealed laps to be an acceptable flashing backer for combustible substrates.

The flashing backer should extend onto the roof surface a minimum of 2 inches beyond the cant strip and extend vertically upward to the height at which the finished membrane flashing will be applied.

For combustible substrates with properly configured flashing backers, NRCA considers torchapplied application of polymer-modified bitumen membrane flashings by the direct torching method

to be appropriate provided low output (105,000 Btu output or less) torching equipment is used.

The following construction details for built-up and polymer-modified bitumen membranes depict membrane flashing configurations over combustible flashing substrates NRCA considers appropriate.

BUR(T)-1—Base Flashing at Parapet Wall With Metal Coping (Torch-applied Flashing Systems)

BUR(T)-7—Base Flashing at Roof-to-wall Expansion Joint (Torch-applied Flashing Systems)

BUR(T)-8—Base Flashing at Expansion Joint With Metal Cover (Torch-applied Flashing Systems)

BUR(T)-9—Base Flashing at Area Divider in Roof System (Torch-applied Flashing Systems)

BUR(T)-10—Base Flashing at Equipment Support Curb (Torch-applied Flashing Systems)

BUR(T)-13—Base Flashing at Wood Curb (Torch-applied Flashing Systems)

BUR(T)-14—Base Flashing at Structural Member Through Roof Deck (Torch-applied Flashing Systems)

BUR(T)-15—Base Flashing at Sheet-metal Enclosure for Piping Through Roof Deck (Torch-applied Flashing Systems)

BUR(T)-17—Base Flashing at Stack Vent With Curb [Hot or Cold] (Torch-applied Flashing Systems)

MB(T)-1—Base Flashing at Parapet Wall With Metal Coping (Torch-applied Flashing Systems)

MB(T)-7—Base Flashing at Roof-to-wall Expansion Joint (Torch-applied Flashing Systems)

MB(T)-8—Base Flashing at Expansion Joint With Metal Cover (Torch-applied Flashing Systems)

MB(T)-9—Base Flashing at Area Divider in Roof System (Torch-applied Flashing Systems)

MB(T)-10—Base Flashing at Equipment Support Curb (Torch-applied Flashing Systems)

MB(T)-13—Base Flashing at Wood Curb (Torchapplied Flashing Systems)

MB(T)-14—Base Flashing at Structural Member Through Roof Deck (Torch-applied Flashing Systems)

MB(T)-15—Base Flashing at Sheet-metal Enclosure for Piping Through Roof Deck (Torch-applied Flashing Systems)

MB(T)-17—Base Flashing at Stack Vent With Curb [Hot or Cold] (Torch-applied Flashing Systems)

Where potential fire hazards cannot be adequately mitigated, NRCA recommends the direct torching method of membrane flashing application be avoided. Instead, membrane flashings can be applied to appropriate backer flashing configurations using hot- or cold-applied methods of application or indirect torching methods, such as the torch-and-flop method.

Additional information regarding the safe application of torch-applied polymer-modified bitumen membranes is provided in the CERTA roof torch safety program.

Liquid-applied Flashing for Built-up and Polymer-modified Bitumen Roof Systems:

A number of built-up roof (BUR-) and polymermodified bitumen (MB-) construction details depict liquid-applied flashings that consist of a base coat, polyester fabric reinforcement and a top coat extending onto the roof surface. Surfacings, such as a coating or granules, may be applied in some systems.

- Specific configurations of liquid-applied flashings may vary by individual roof system. Roof system and liquid-applied flashing manufacturers' specific requirements for liquid-applied flashings should be consulted.
- A recommended maximum membrane flashing height may no longer be applicable for certain roof membrane types. Fluidapplied membranes are acceptable for vertical installations.

The following construction details for built-up and polymer-modified bitumen membranes depict

flashing configurations using liquid-applied flashings.

BUR(L)-11—Equipment Support Stand Leg (Liquid-applied Flashing Systems)

BUR(L)-14—Structural Roof Member Through Roof Deck (Liquid-applied Flashing Systems)

BUR(L)-18—Sheet-metal Stack Vent [Hot or Cold] (Liquid-applied Flashing Systems)

BUR(L)-19—Plumbing Vent (Liquid-applied Flashing Systems)

BUR(L)-20—Pipe Penetration—Single Penetration (Liquid-applied Flashing Systems)

BUR(L)-23—Cable Penetration (Liquid-applied Flashing Systems)

BUR(L)-26—Through-wall Scupper (Liquid-applied Flashing Systems)

BUR(L)-27—Overflow Scupper (Liquid-applied Flashing Systems)

MB(L)-4—Base Flashing with Surface-mounted Counterflashing at Concrete Wall (Liquid-applied Flashing Systems)

MB(L)-11—Equipment Support Stand Leg (Liquid-applied Flashing Systems)

MB(L)-14—Structural Roof Member Through Roof Deck (Liquid-applied Flashing Systems)

MB(L)-18—Sheet-metal Stack Vent [Hot or Cold] (Liquid-applied Flashing Systems)

MB(L)-19—Plumbing Vent (Liquid-applied Flashing Systems)

MB(L)-20—Pipe Penetration—Single Penetration (Liquid-applied Flashing Systems)

MB(L)-23—Cable Penetration (Liquid-applied Flashing Systems)

MB(L)-26—Through-wall Scupper (Liquid-applied Flashing Systems)

MB(L)-27—Overflow Scupper (Liquid-applied Flashing Systems)

EPDM/Thermoplastic Membrane Flashing and Stripping Plies: The type of membrane system, substrate and surfacing method usually dictates the number, type and method of attachment for flashing sheets and stripping plies.

- A recommended maximum membrane flashing height may no longer be applicable for certain roof membrane types. Single-ply membranes are acceptable for vertical installations. However, it is suggested a separator consisting of a counterflashing or cladding be installed to separate the roof flashing from the wall covering.
- Stripping plies for single-ply roof systems may consist of the same membrane as the roof system, a self-adhering membrane strip, or an unreinforced, uncured membrane sheet.

EPDM/Thermoplastic Membrane Base Securement: Base securement options for EPDM membranes are provided in Figures 10-2 and 10-3 on pages 316 and 317. Additionally, Figures 10-4 and 10-5 on pages 318 and 319 show options for securing EPDM membranes into a steel stud wall.

Base securement options for thermoplastic membranes are provided in Figure 10-6 on page 320. Additionally, Figures 10-7 an 10-8 on pages 321 and 322 show options for securing thermoplastic membranes into a steel stud wall.

Fasteners used to secure the reinforcing strip or membrane must be securely attached to the substrate or roof deck. Where fasteners are installed into a metal deck, they must penetrate the top of the rib; therefore, the distance a fastener and/or reinforcing strip is placed away from a wall can vary along the perimeter edge. Where fasteners are installed into a wall, they must penetrate structural wall framing or a substrate securely attached to wall framing. The substrate and its attachment must provide a continuous load patch to structural wall framing.

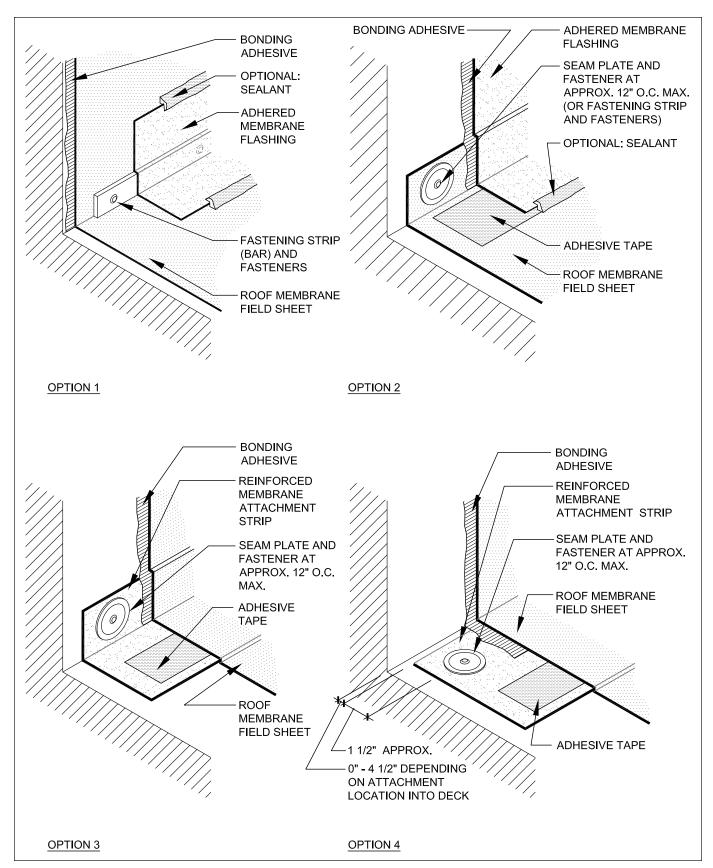


Figure 10-2: Base securement options for EPDM membranes

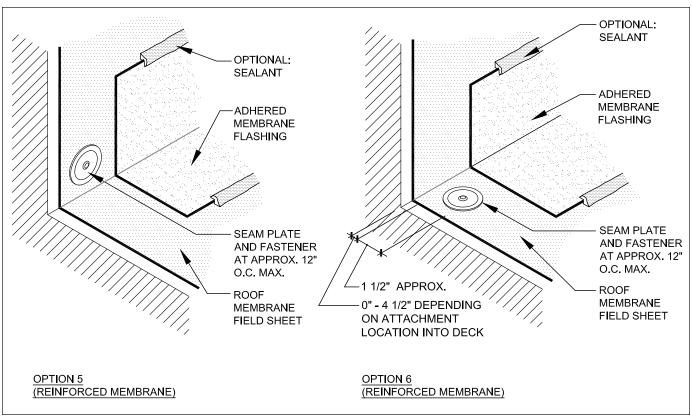


Figure 10-3: Additional base securement options for EPDM membranes of a mechanically attached single-ply roof system

Independent Securement of Mechanically Attached Single-ply Roof Membranes: For mechanically attached single-ply membrane roof systems, NRCA suggests the designer consider the inclusion of a mechanically fastened batten bar or plates approximately 6 inches to 12 inches away from the outside edge of the roof system, drain sumps, curbs and penetrations as independent membrane securement. This is commonly referred to as a peel-stop. See Figures 10-9 and 10-10 on pages 323 and 324 for examples. The batten bar or plates should be installed on top of the membrane with fasteners penetrating into the deck. The batten bar or plates should be stripped in with an additional layer of membrane. The stripping ply laps should be made waterproof by bonding with adhesive tape or a liquid-applied adhesive for EPDM roof membranes and by hot-air welding for thermoplastic roof membranes. The width of the stripping membrane should be a minimum of 6 inches. Wider stripping sheets may be required depending on the required lap dimension for the specific sheet type.

Rooftop Equipment and Associated Flash-

ing: NRCA does not recommend using a roof as a location for heating, ventilating and air-conditioning equipment. Weatherproofing-related problems may be encountered because of the design of an HVAC unit. There often is a lack of clearly defined responsibility for the weatherproofing of HVAC units among the parties involved, such as contractors, material suppliers and manufacturers. Running conduits and pipes within the interior of rooftop curbs will minimize rooftop penetrations.

Many weatherproofing problems related to HVAC equipment may be attributed to one or more of the following:

- Improper design of the equipment's exterior shell or housing. This may allow water to enter the building directly through the unit.
- Improper design or penetration of condensate pans or drainage lines. This may allow water to enter the building below the HVAC equipment.

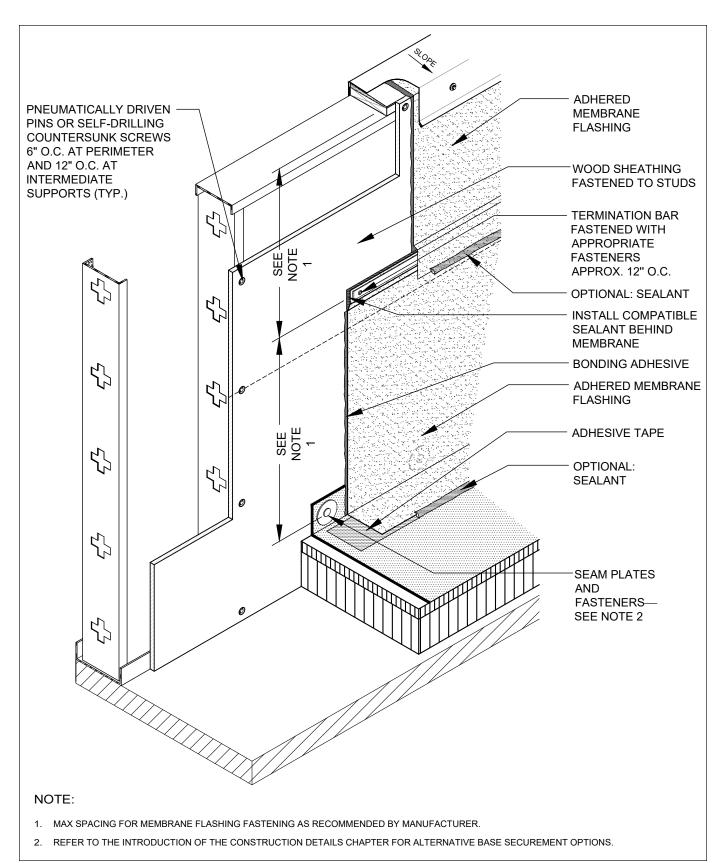


Figure 10-4: Base securement for EPDM membranes at a steel stud wall with wood sheathing fastening substrate

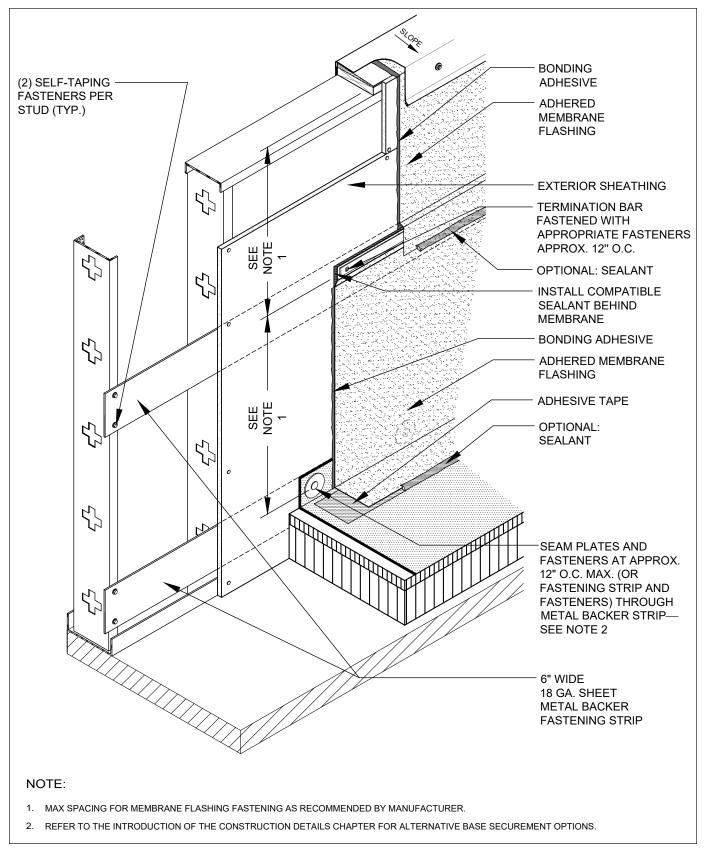


Figure 10-5: Base securement for EPDM membranes at a steel stud wall with steel fastening substrate

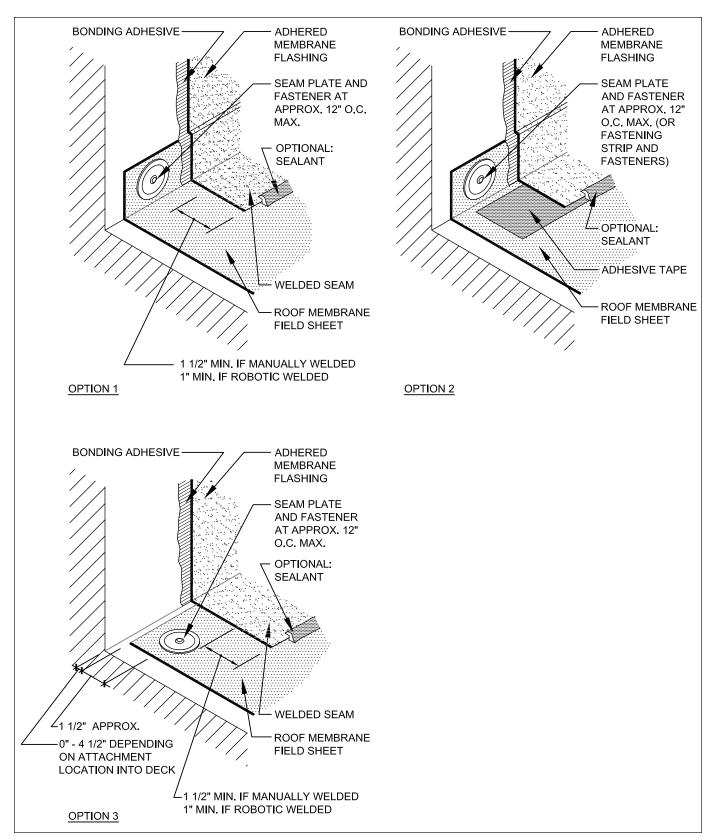
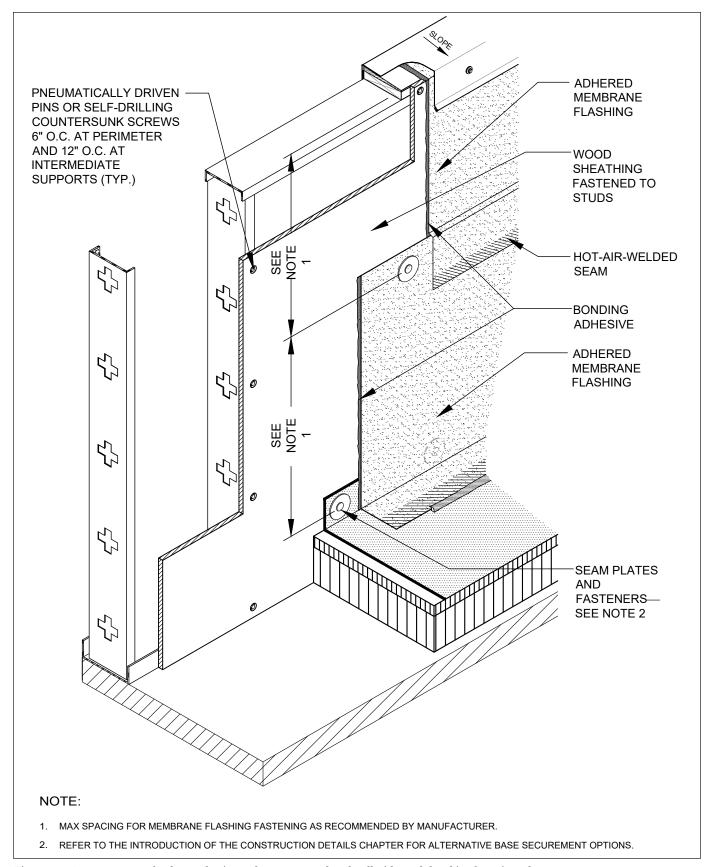
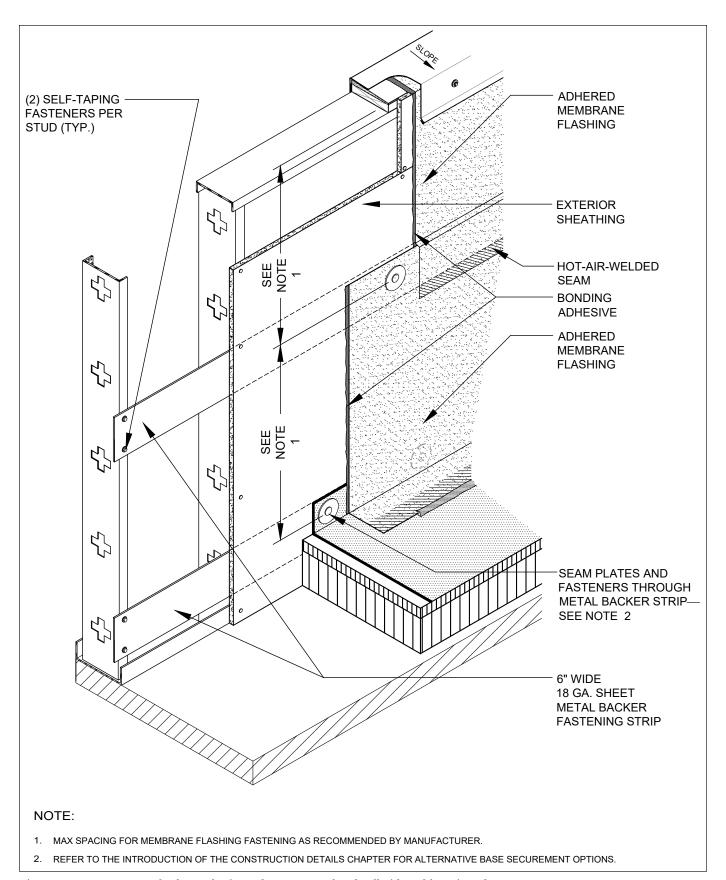


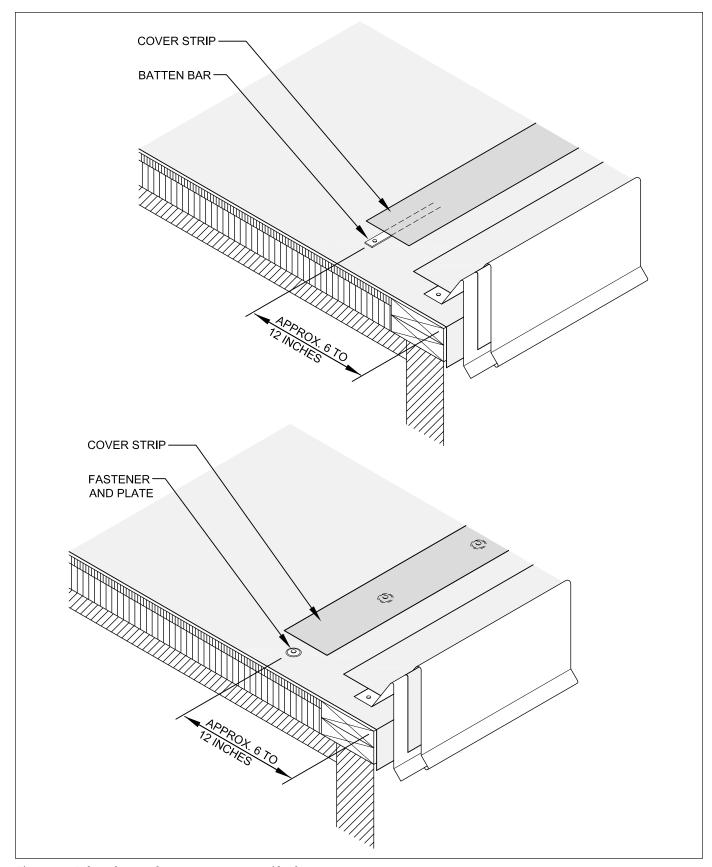
Figure 10-6: Base securement options for thermoplastic membranes



 $Figure~10\mbox{-}7: Base~securement~for~thermoplastic~membranes~at~a~steel~stud~wall~with~wood~sheathing~fastening~substrate$



Figure~10--8: Base~securement~for~thermoplastic~membranes~at~a~steel~stud~wall~with~steel~fastening~substrate



 $Figure \ 10-9: Independent\ membrane\ securement\ at\ outside\ edge$

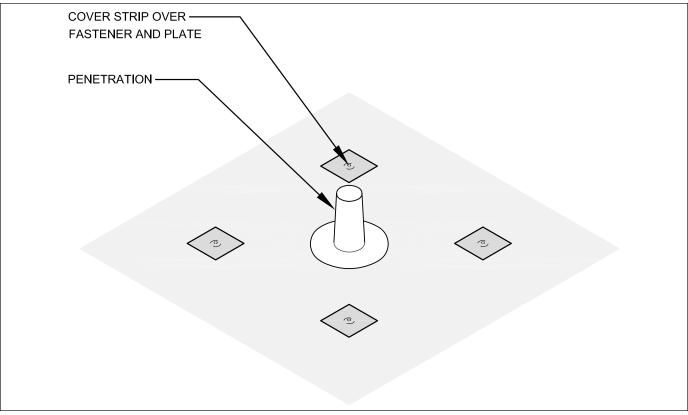


Figure 10-10: Independent membrane securement at a penetration in a mechanically attached single-ply roof system

- Improper design of premanufactured HVAC equipment curbs. There often are no means to properly attach base flashings.
- Inadequate design of the structural framing or roof deck intended to support the weight of HVAC units. This may result in excessive roof deflection and subsequent ponding water.
- Improper flashing of the penetration(s), such as pipes, conduits and drain lines, that extend through the roof to service the HVAC equipment
- Lack of service walkways to and around mechanical equipment for rooftop traffic

Expansion Joints: The expansion joints depicted generally provide movement capability in longitudinal and transverse directions and must be designed to accommodate the amount of expected movement. It is the designer's responsibility to determine the amount and direction of expected movement at expansion joints. The expansion joints depicted

generally will not accommodate seismic movement. Where seismic movement is expected, alternative details likely are needed.

Skylights: Skylights require fall protection. NRCA suggests permanent internal or external fall-protection devices be included at all skylights.

Drains and Drain Sumps: A sump is an intentional depression around a roof drain or scupper that promotes drainage. Drain sumps are recommended at internal drain locations. Drain sumps may not be necessary where tapered insulation systems provide adequate slope for drainage. They reduce the potential for localized ponding at drain locations because of a buildup of materials and a drain clamping ring. Drain sumps should be square or rectangular and typically are 4 feet or 8 feet per side where premanufactured sump insulation is used. NRCA suggests drain sump dimensions not be less than the drain bowl diameter plus 24 inches to allow for correct drain flashing installation. For example, if a drain bowl's diameter is 12 inches. the drain sump should not be smaller than

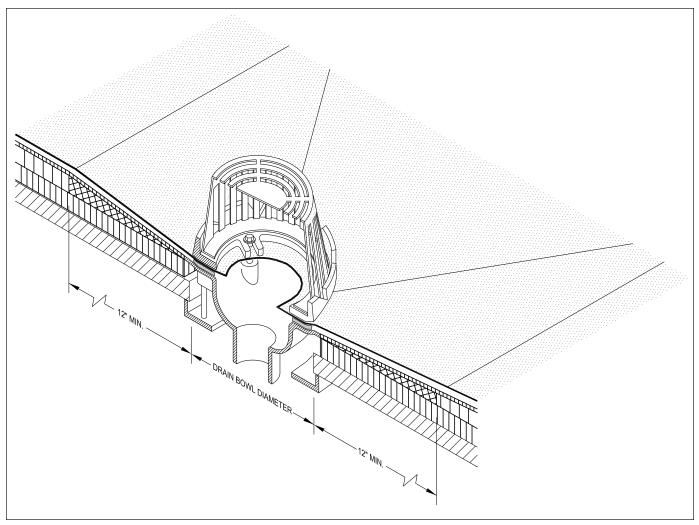


Figure 10-11: Drain sump guidelines

approximately 36 inches by 36 inches. See Figure 10-11. NRCA does not recommend the use of metal sump pans.

Where a primary and overflow drain are located inside a common sump, they should be spaced to allow for correct drain flashing installation. NRCA suggests the spacing between drains be 12-18 inches to allow for proper flashing of each drain. See Figure 10-12 on page 326.

Where separate drainage provisions are to be made for a temporary roof system and finished roof system, NRCA recommends the use of roof drains with adjustable extensions. With the temporary roof system terminated to the drain and extension removed, they permit roof drainage during construction. The extension height may be adjusted for the specified insulation thickness required at the drain with the

finished roof system. The extension is replaced during construction of the permanent roof system and flashed into the finished roof membrane. Appendix 3—Temporary Roof Systems provides additional information.

Crickets and Saddles: The use of tapered insulation may not necessarily result in complete, immediate drainage of roof membrane surfaces. Some residual surface water may remain on the roof membrane surfaces at junctures, transitions and immediate drain areas following periods of rain. To help reduce the amount of residual surface water between drains, behind curbs and along roof edges between scuppers, NRCA recommends installing crickets and saddles. Figures 10-13 and 10-14 on pages 327-328 provide additional information regarding cricket and saddle slope and length-to-

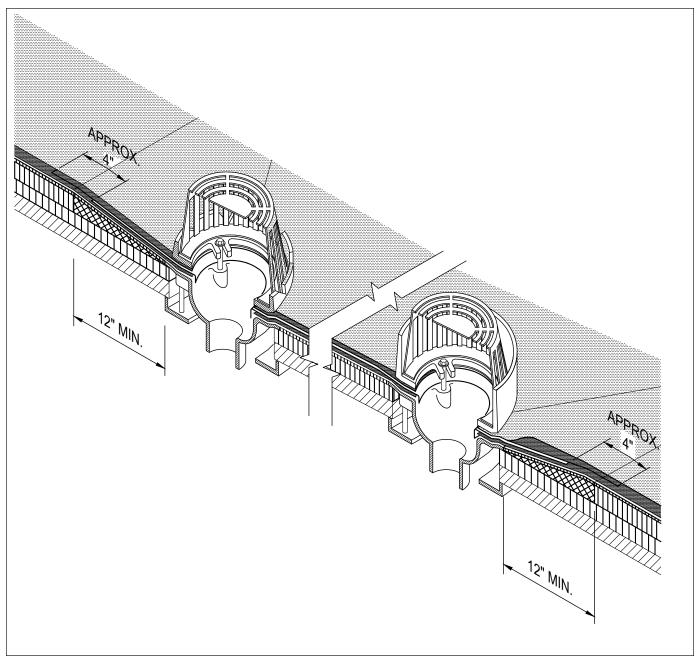


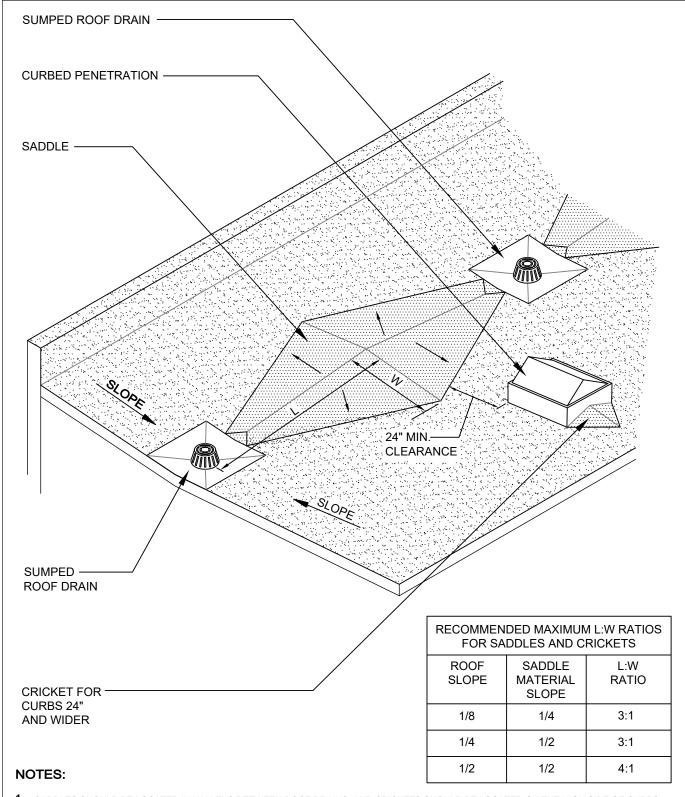
Figure 10-12: Drain sump guidelines—combination primary and overflow drain

width ratios. See Chapter 4—Rigid Board Insulation for additional information about cricket and saddle layout and design.

Membrane Corner Flashings: Construction of roof membrane flashings at corners of curbs and parapet walls involves following system-specific application procedures. NRCA recommends the following corner flashing application procedures for BUR and polymer-modified bitumen roof membranes, EPDM roof membranes and thermoplastic roof membranes.

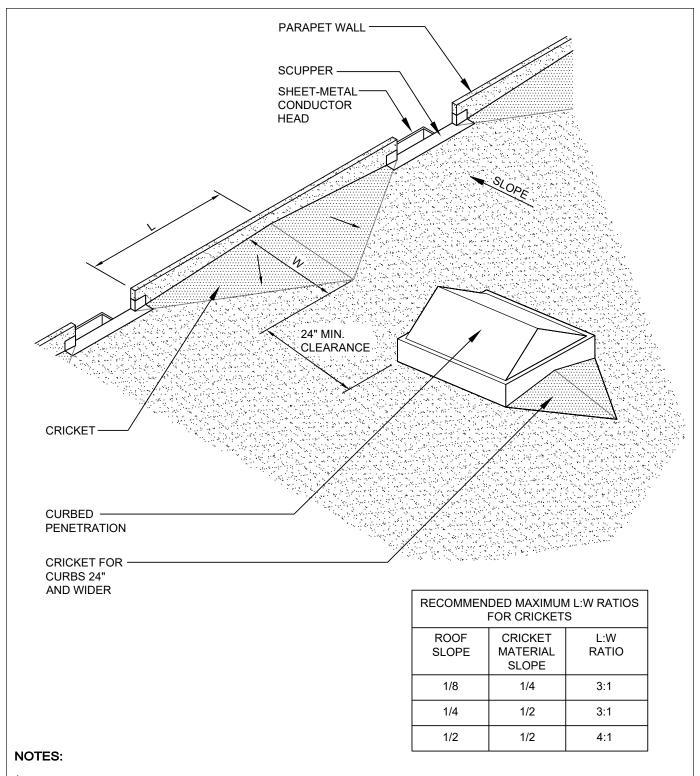
BUR and Polymer-modified Bitumen Membrane Corner Flashings: BUR and polymer-modified bitumen roof membrane corner flashing application involves a number of steps wherein flashing sheets are interlaced across the plane change. Figure 10-15 on pages 329 to 332 and Figure 10-16 on pages 333 to 336 illustrate the sequencing of steps for inside and outside corner flashing application.

At the base of curbs, parapet walls and deck-to-wall transitions, a tapered cant of compatible material



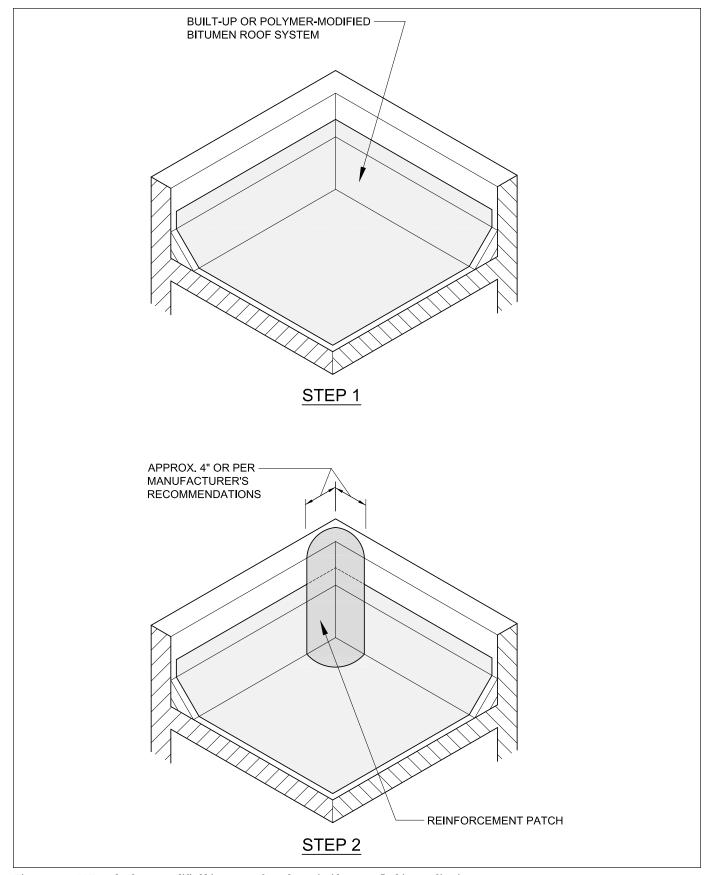
- 1. SADDLES SHOULD BE LOCATED IN VALLEYS BETWEEN ROOF DRAINS, AND CRICKETS SHOULD BE LOCATED ON THE HIGH SIDE OF CURBS.
- LOCATE ROOF DRAINS AT POINTS OF MAXIMUM DECK DEFLECTION/LOW AREAS FOR DRAINAGE.
 SADDLE INSULATION MAY BE SANDWICHED BETWEEN LAYERS OF FLAT STOCK INSULATION.

 $Figure~10\mbox{-}13: Guide~for~crickets~and~saddles$

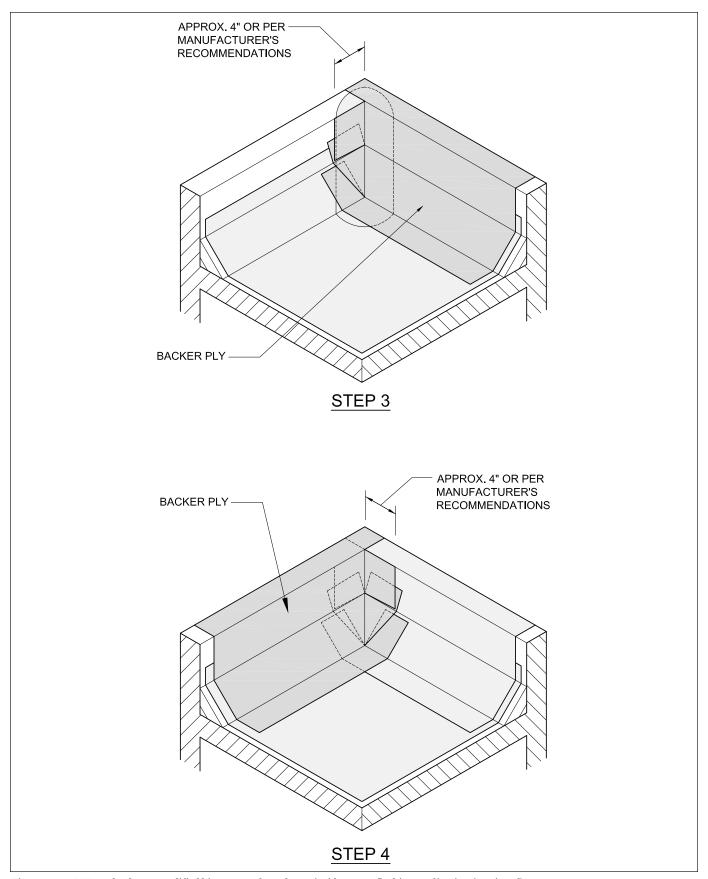


- CRICKETS SHOULD BE LOCATED BETWEEN PERIMETER AND/OR THROUGH-WALL SCUPPERS AND ON THE HIGH SIDE OF CURBS. RAISED PERIMETER EDGES WHERE TAPERED CRICKETS ARE USED MAY NECESSITATE THE USE OF RELATIVELY WIDE (TALL) DIMENSIONAL LUMBER OR THE ERECTION OF FRAMED WALLS.
- SADDLE INSULATION MAY BE SANDWICHED BETWEEN LAYERS OF FLAT STOCK INSULATION.

Figure 10-14: Guide for crickets



Figure~10-15: BUR~and~polymer-modified~bitumen~roof~membrane~inside~corner~flashing~application



Figure~10-15:~BUR~and~polymer-modified~bitumen~roof~membrane~inside~corner~flashing~application~(continued)

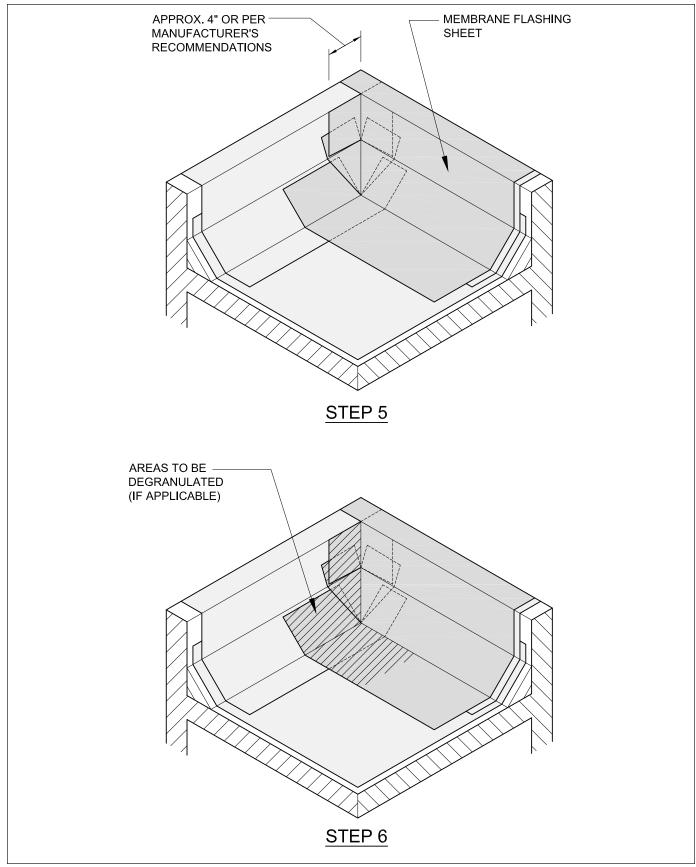


Figure 10-15: BUR and polymer-modified bitumen roof membrane inside corner flashing application (continued)

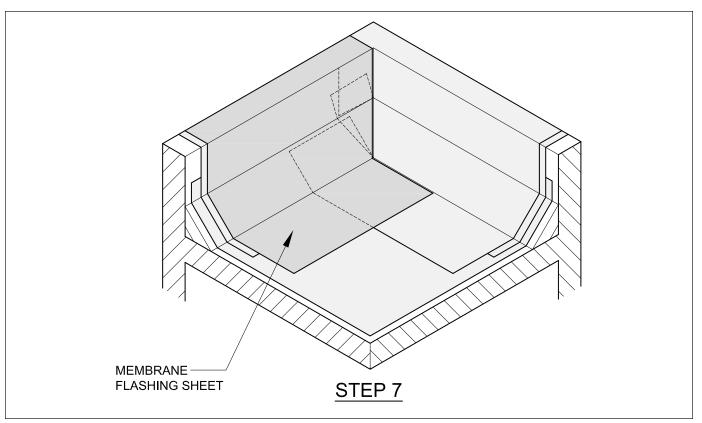
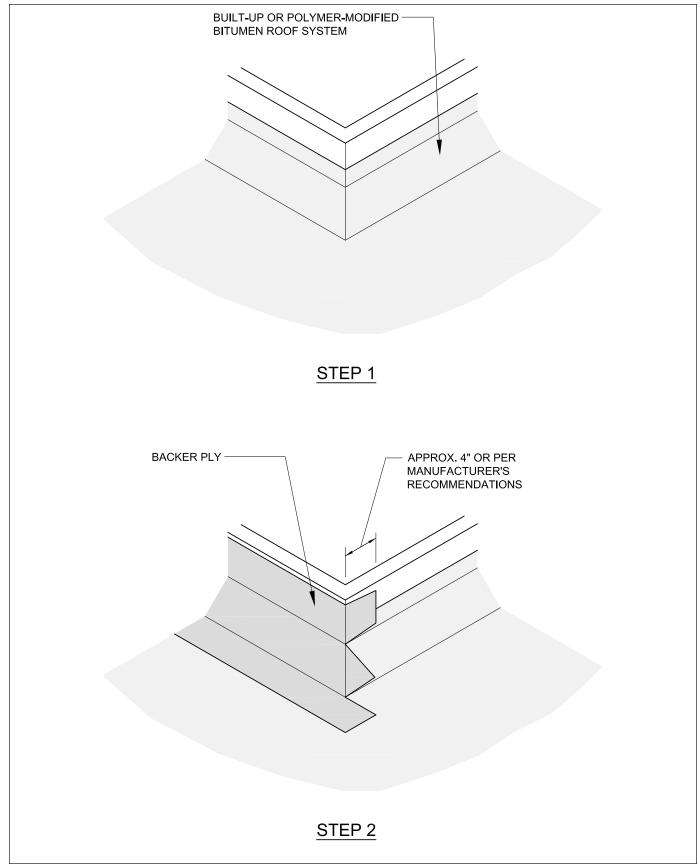


Figure 10-15: BUR and polymer-modified bitumen roof membrane inside corner flashing application (continued)

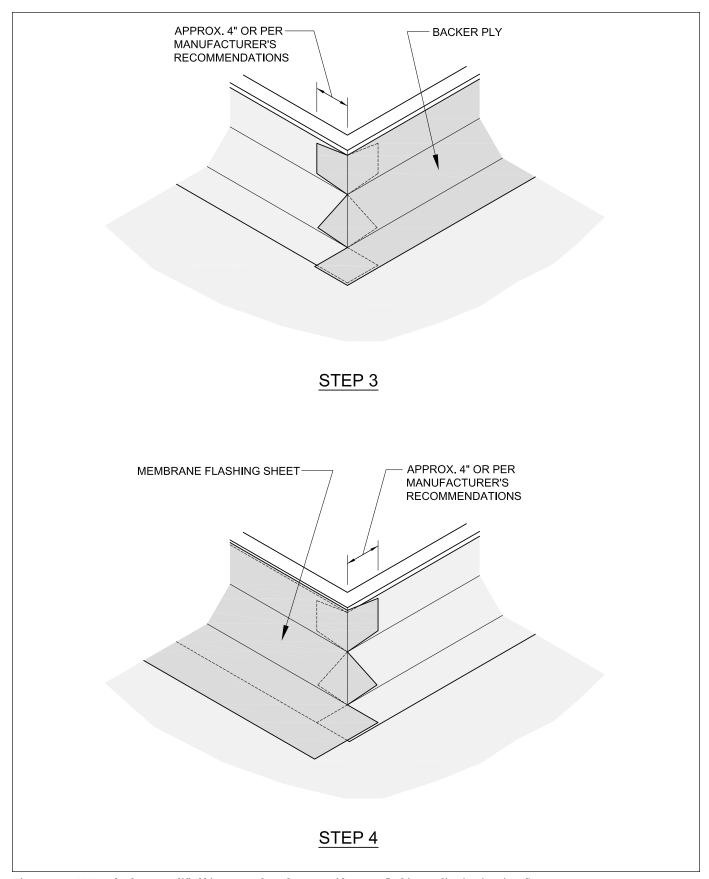
is placed on the roof deck or substrate. Field plies and sheets should be extended past the top of the cant. Substrates of concrete, masonry, metal and gypsum board should be primed before adhering flashing sheets. Flashing sheets should be trimmed to provide tabs that wrap around corners a minimum of approximately 4 inches or the manufacturer-recommended minimum overlap. Before heat welding to granule-surfaced cap sheets, the receiving surfaces should be degranulated (heated with granules pressed into the membrane bitumen). Reinforcing patches of flashing sheet material should be heat-welded over cant transitions. Alternatively, liquid-applied flashings may be used for corner flashing reinforcement. Matching granules may be broadcast into liquid-applied flashing resin and bitumen bleed-out. Manufacturers' instructions should be consulted for product-specific recommendations.

EPDM Membrane Corner Flashings: A number of techniques commonly are used for EPDM membrane corner flashing construction. For flashing inside corners, it is suggested field membranes be used to bridge the roof-to-wall transition to provide a continuous wall flashing. Figure 10-17 on pages 337-339 illustrates the sequencing of steps for this technique. Membrane adhesive should be applied inside the trimmed corner fold and the fold secured flush against the wall with adhesive. The area should be cleaned using EPDM primer. A pre-cut self-adhering flashing should be adhered to completely cover the fold and provide a lap of at least 3 inches or the manufacturer-recommended minimum. Flashing edges should be sealed with lap sealant as required by the manufacturer.

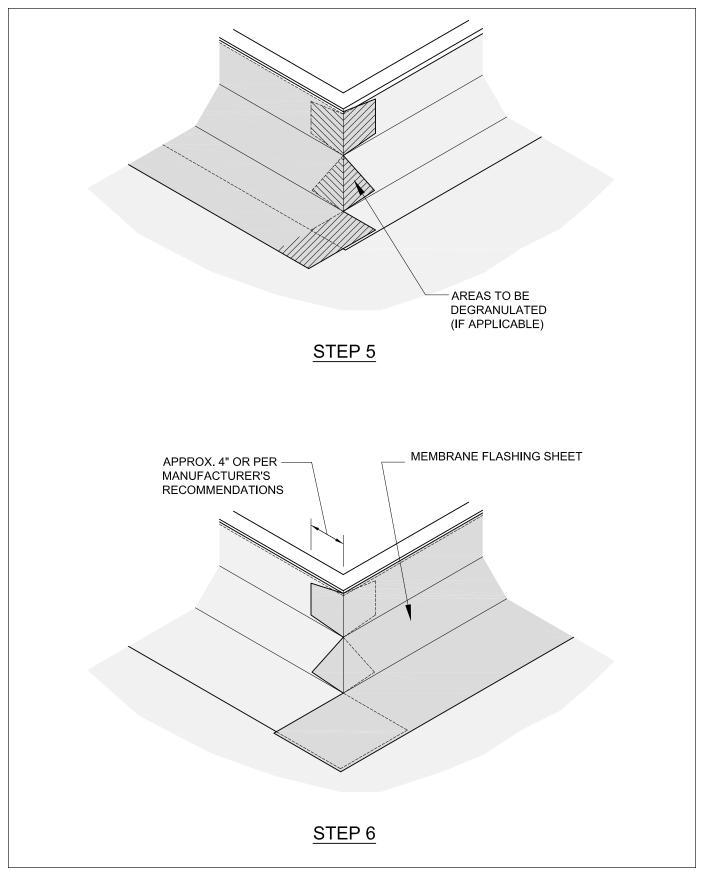
Figures 10-18 on pages 340 and 341 and 10-19 on pages 342 and 343 illustrate two options for flashing outside corners. Areas to be flashed should be



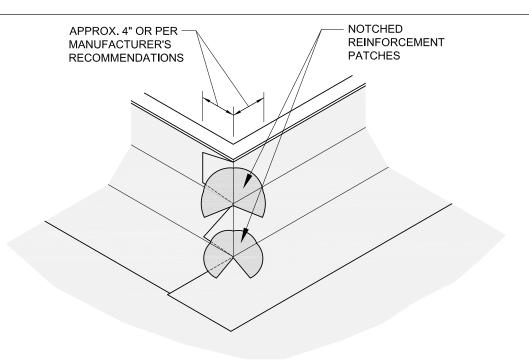
Figure~10-16: BUR~and~polymer-modified~bitumen~roof~membrane~outside~corner~flashing~application



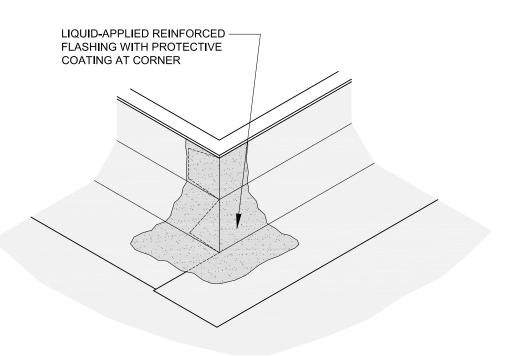
Figure~10-16: BUR~and~polymer-modified~bitumen~roof~membrane~outside~corner~flashing~application~(continued)



Figure~10-16: BUR~and~polymer-modified~bitumen~roof~membrane~outside~corner~flashing~application~(continued)

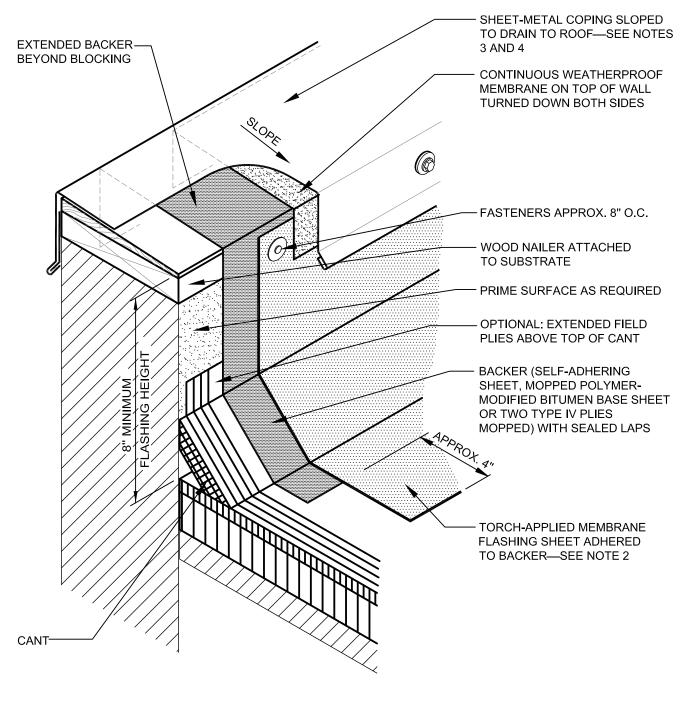


STEP 7—OPTION WITH REINFORCEMENT PATCHES



STEP 7—OPTION WITH LIQUID-APPLIED REINFORCED FLASHING

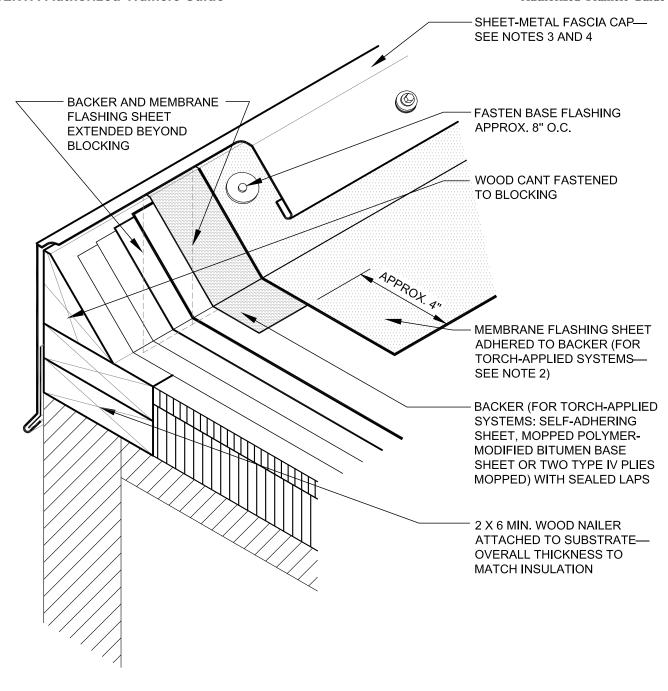
Figure~10-16: BUR~and~polymer-modified~bitumen~roof~membrane~outside~corner~flashing~application~(continued)



- 1. THIS DETAIL DOES NOT ALLOW FOR DIFFERENTIAL MOVEMENT BETWEEN THE DECK AND WALL. SEE DETAIL BUR(T)-7 FOR EXPANSION JOINT AT A DECK-TO-WALL LOCATION.
- WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 3. REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR COPINGS.
- 4. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



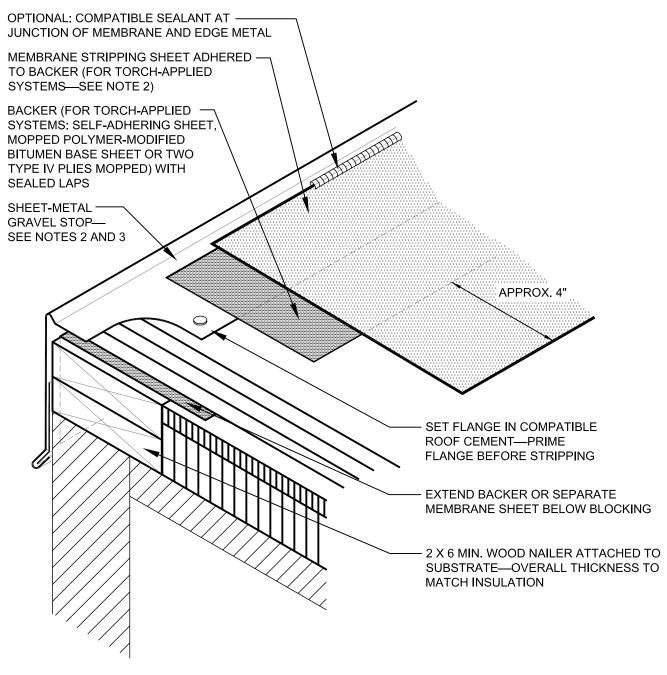
BASE FLASHING AT PARAPET WALL WITH METAL COPING (TORCH-APPLIED FLASHING SYSTEMS)



- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (50,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 3. REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR FASCIA CAPS.
- 4. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



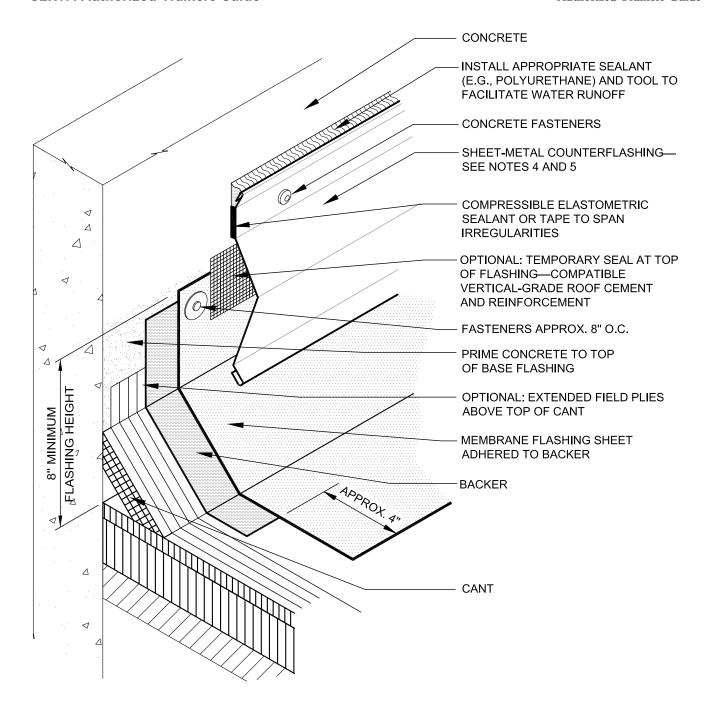
RAISED PERIMETER EDGE WITH METAL FLASHING [FASCIA CAP] (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)



- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 3. REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR GRAVEL STOPS.
- ${\tt 4.}\;{\tt REFER}\;{\tt TO}\;{\tt THE}\;{\tt INTRODUCTION}\;{\tt OF}\;{\tt THE}\;{\tt CONSTRUCTION}\;{\tt DETAILS}\;{\tt CHAPTER}\;{\tt FOR}\;{\tt ADDITIONAL}\;{\tt INFORMATION}.$



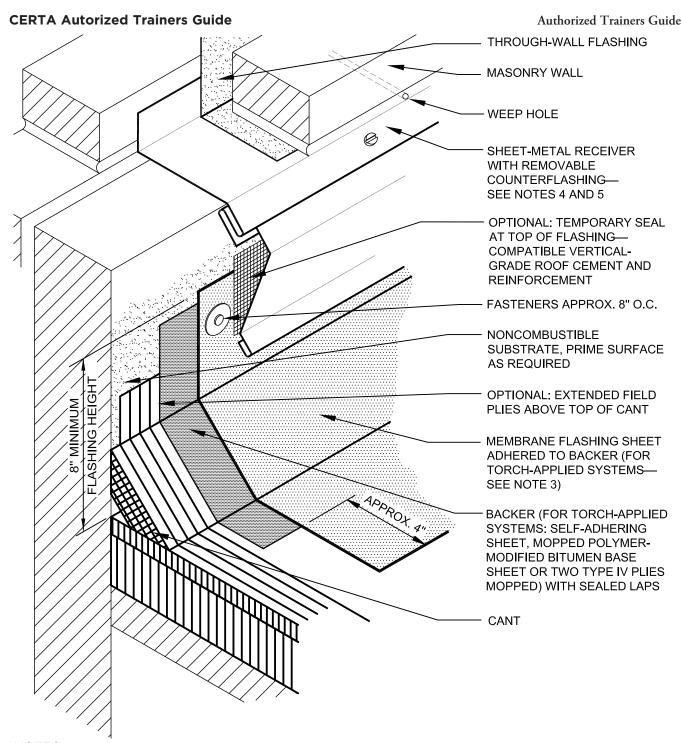
EMBEDDED EDGE-METAL FLASHING [GRAVEL STOP] (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)



- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2. THIS DETAIL DOES NOT ALLOW FOR DIFFERENTIAL MOVEMENT BETWEEN THE DECK AND WALL.
- 3. COUNTERFLASHING DETAIL MAY BE A TWO-PIECE REGLET AND COUNTERFLASHING (SEE THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR SHEET-METAL COUNTERFLASHING OPTIONS).
- 4. REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR COUNTERFLASHINGS.
- 5. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



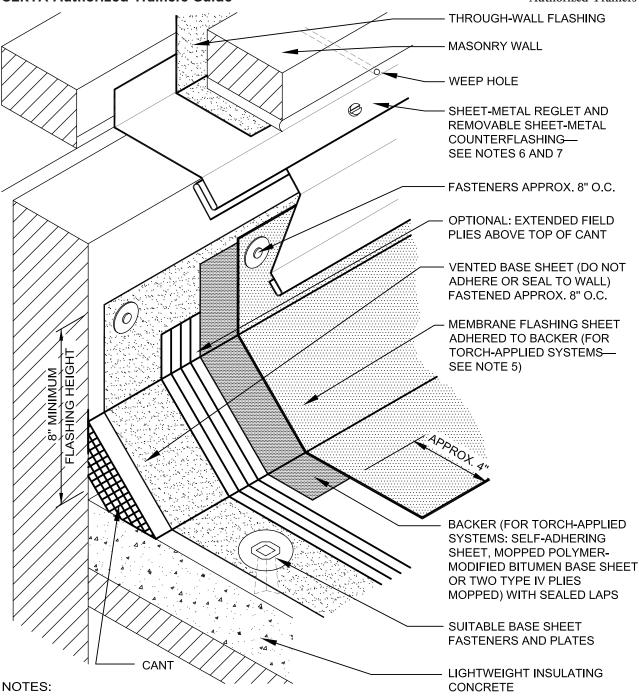
BASE FLASHING WITH SURFACE-MOUNTED COUNTERFLASHING AT CONCRETE WALL (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)



- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2. THIS DETAIL DOES NOT ALLOW FOR DIFFERENTIAL MOVEMENT BETWEEN THE DECK AND WALL.
- 3. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 4. REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR COUNTERFLASHINGS.
- 5. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



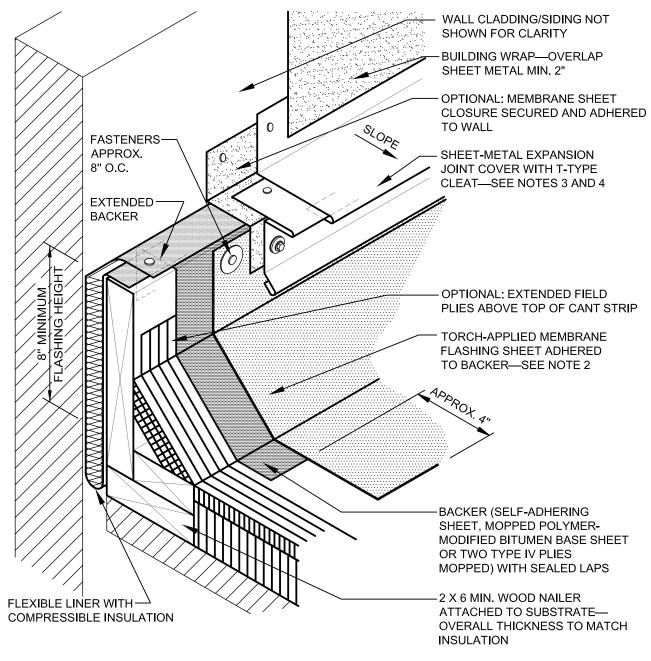
BASE FLASHING WITH TWO-PIECE SHEET-METAL COUNTERFLASHING (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)



- THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2- THIS DETAIL TO BE USED OVER WET-FILL DECKS (E.G., LIGHTWEIGHT INSULATING CONCRETE).
- 3. THIS DETAIL DOES NOT ALLOW FOR DIFFERENTIAL MOVEMENT BETWEEN THE DECK AND WALL.
- 4. ALL PLIES ARE TO BE SOLIDLY MOPPED TO THE BASE SHEET. CARE SHOULD BE USED NOT TO ADHERE THE BASE SHEET TO THE WALL.
- 5. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 6. REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR COUNTERFLASHINGS.
- 7. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



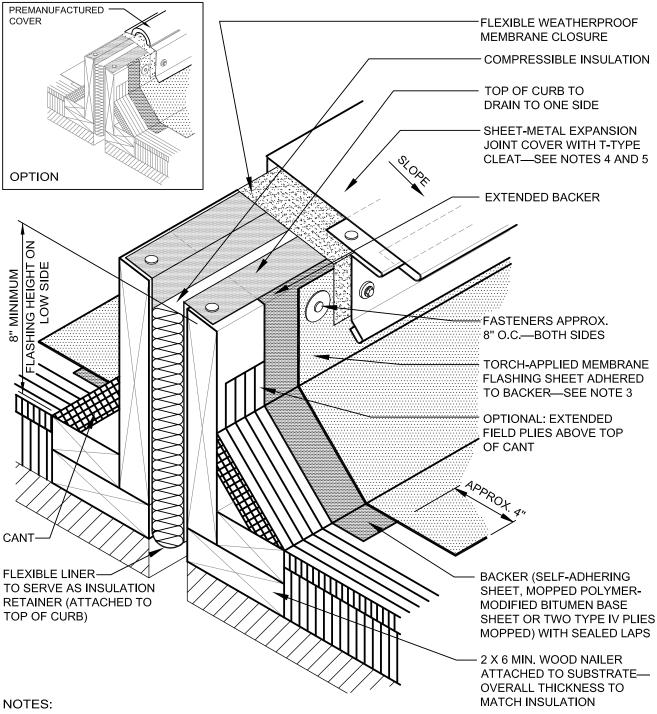
BASE FLASHING WITH VENTED BASE SHEET (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)



- 1. THIS DETAIL SHOULD BE USED WHEN THERE IS ANY POSSIBILITY DIFFERENTIAL MOVEMENT WILL OCCUR BETWEEN THE DECK AND A VERTICAL SURFACE. THE WOOD MEMBERS SHOULD NOT BE FASTENED TO THE WALL.
- 2. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 3. REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR EXPANSION JOINT COVERS.
- 4. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



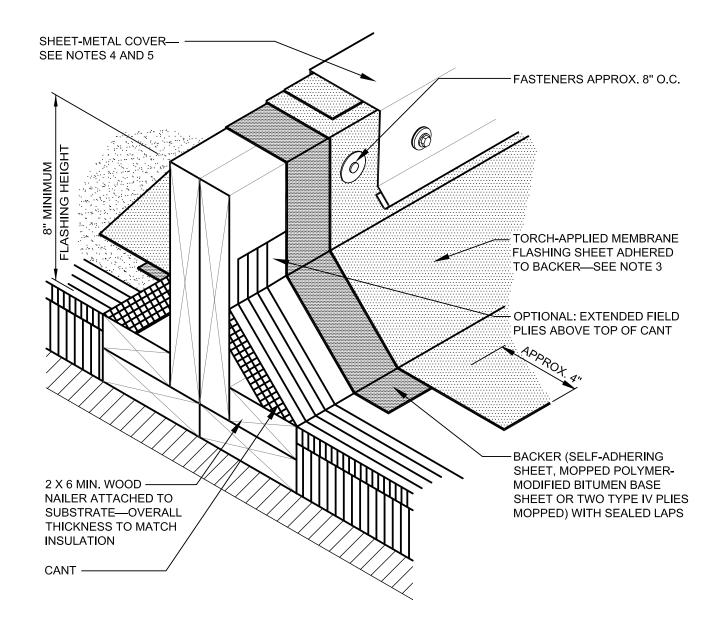
BASE FLASHING AT ROOF-TO-WALL EXPANSION JOINT (TORCH-APPLIED FLASHING SYSTEMS)



- 1. THIS DETAIL ALLOWS FOR BUILDING MOVEMENT IN MULTIPLE DIRECTIONS.
- 2. FLASHING REQUIREMENTS ARE TYPICAL FOR BOTH SIDES OF THE EXPANSION JOINT.
- 3. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 4. REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR EXPANSION JOINT COVERS.
- 5. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



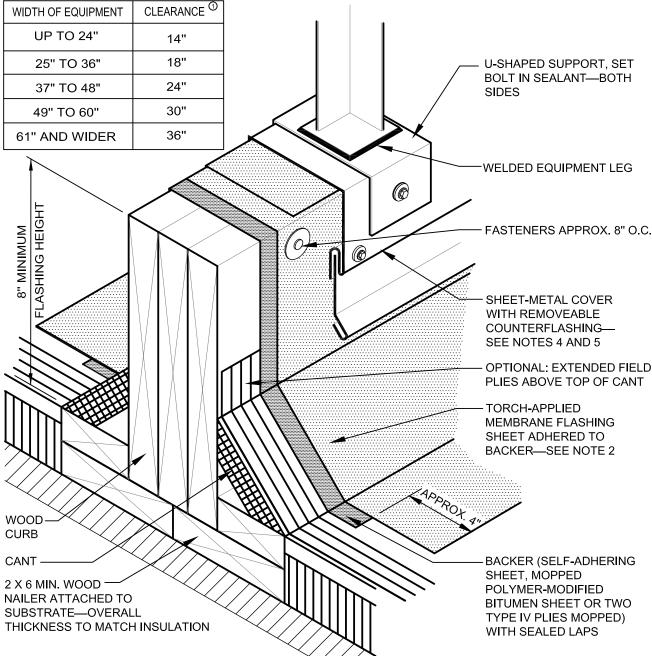
BASE FLASHING AT EXPANSION JOINT WITH METAL COVER (TORCH-APPLIED FLASHING SYSTEMS)



- 1. AN AREA DIVIDER SHOULD NEVER RESTRICT THE FLOW OF WATER.
- 2. FLASHING REQUIREMENTS ARE TYPICAL FOR BOTH SIDES OF THE AREA DIVIDER.
- 3. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 4- REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR SHEET-METAL COVERS.
- 5. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



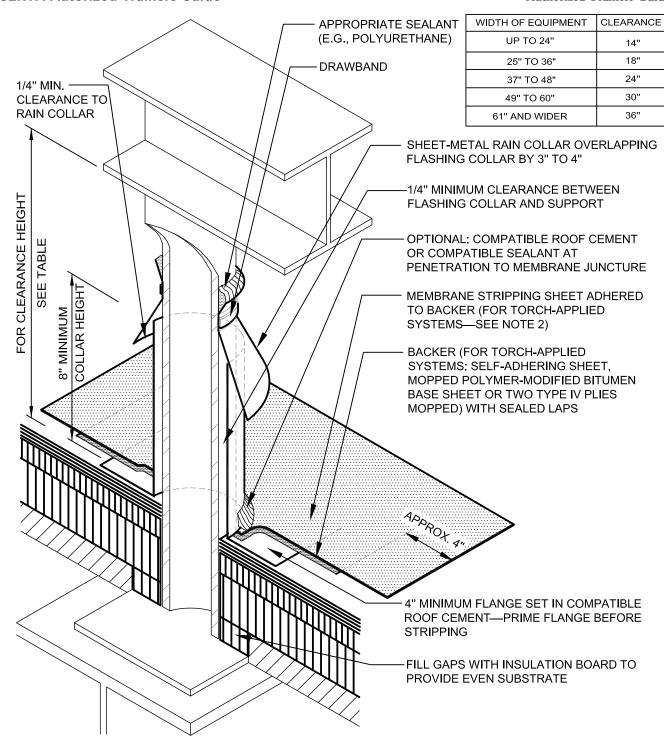
BASE FLASHING AT AREA DIVIDER IN ROOF SYSTEM (TORCH-APPLIED FLASHING SYSTEMS)



- 1. THIS DETAIL ALLOWS FOR MEMBRANE MAINTENANCE AROUND THE SUPPORTED EQUIPMENT. THE CONTINUOUS SUPPORT IS PREFERRED IN LIGHTWEIGHT STRUCTURAL SYSTEMS BECAUSE THE EQUIPMENT WEIGHT CAN BE SPREAD ACROSS TWO OR MORE SUPPORTING MEMBERS. WHERE HEAVY STRUCTURAL SYSTEMS ARE USED OR WHERE THE LOAD CAN BE CONCENTRATED OVER A COLUMN, DETAIL BUR-11 MAY BE PREFERRED. A MINIMUM OF 2 FEET OF HORIZONTAL CLEARANCE MUST BE PROVIDED FOR REMOVAL AND REPLACEMENT OF ROOFING AND FLASHING BETWEEN PARALLEL SUPPORTS. REFER TO THE TABLE ABOVE FOR RECOMMENDATIONS ON VERTICAL CLEARANCE FROM ROOF SURFACE TO THE BOTTOM OF SUPPORTED EQUIPMENT.
- 2. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 3. REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR SHEET-METAL COVERS.
- 4. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



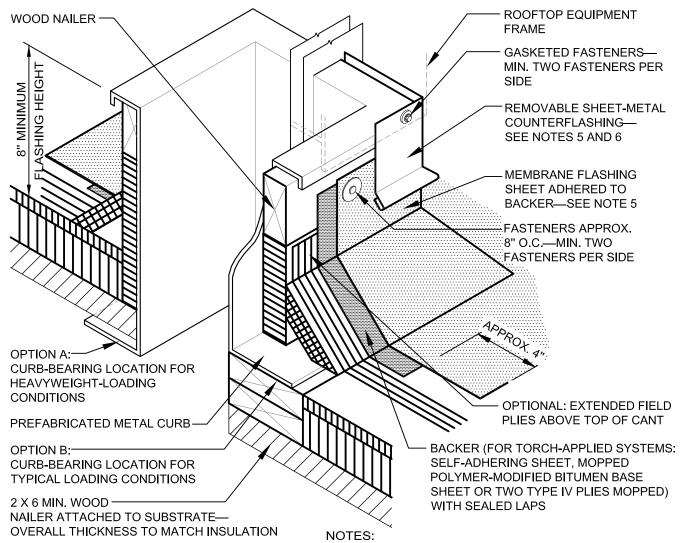
BASE FLASHING AT EQUIPMENT SUPPORT CURB (TORCH-APPLIED FLASHING SYSTEMS)

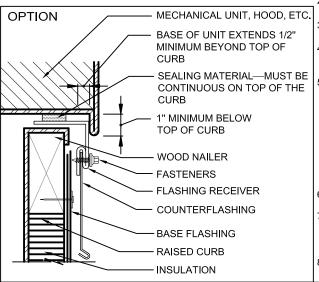


- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 3. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



EQUIPMENT SUPPORT STAND AND TYPICAL RAIN COLLAR PENETRATION (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)

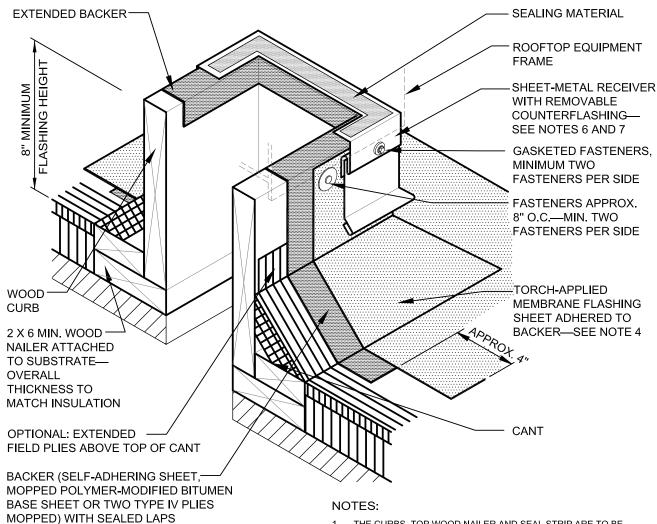


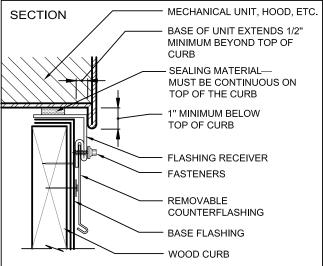


- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2. THE CURBS, TOP WOOD NAILER AND SEAL STRIP ARE TO BE SUPPLIED BY THE CURB MANUFACTURER.
- 3. WHEN POSSIBLE, THE MECHANICAL UNITS SHOULD NOT BE SET UNTIL THE ROOF MEMBRANE AND FLASHING HAVE BEEN INSTALLED.
- 4. WHERE THE SKYLIGHT, SCUTTLE OR SMOKE VENT FRAME OVERLAPS THE BASE FLASHING AT LEAST 3 INCHES, THE REMOVABLE SHEET-METAL COUNTERFLASHING IS NOT REQUIRED.
- 5. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 6. NRCA RECOMMENDS DESIGNERS CONSIDER PERMANENT INTERNAL OR EXTERNAL FALL-PROTECTION DEVICES AT ALL SKYLIGHTS.
- REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR COUNTERFLASHINGS.
- 8. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



BASE FLASHING AT PREFABRICATED METAL CURB (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)

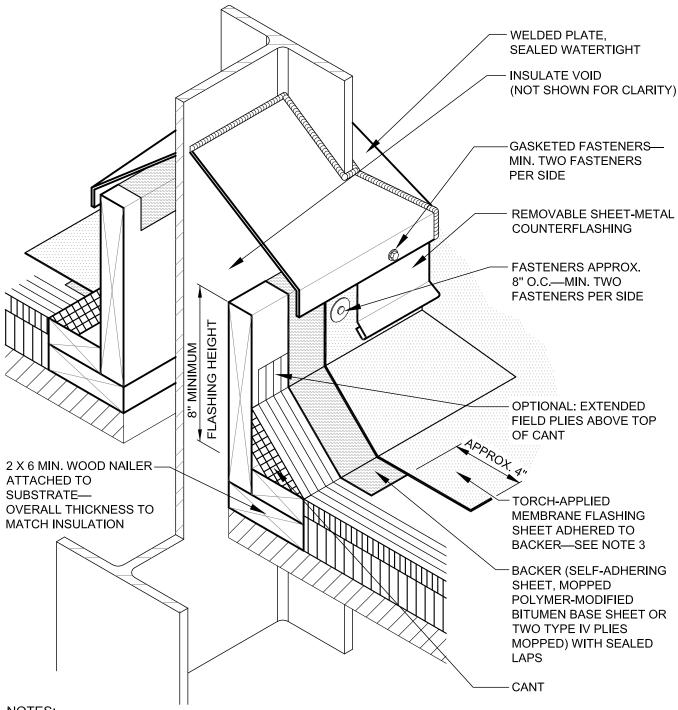




- THE CURBS, TOP WOOD NAILER AND SEAL STRIP ARE TO BE SUPPLIED BY THE CURB MANUFACTURER.
- WHEN POSSIBLE, THE MECHANICAL UNITS SHOULD NOT BE SET UNTIL THE ROOF MEMBRANE AND FLASHING HAVE BEEN INSTALLED.
- 3. WHERE THE SKYLIGHT, SCUTTLE OR SMOKE VENT FRAME OVERLAPS THE BASE FLASHING AT LEAST 3 INCHES, THE REMOVABLE SHEET-METAL COUNTERFLASHING IS NOT REQUIRED.
- 4. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- NRCA RECOMMENDS DESIGNERS CONSIDER PERMANENT INTERNAL OR EXTERNAL FALL-PROTECTION DEVICES AT ALL SKYLIGHTS.
- REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR COUNTERFLASHINGS.
- 7. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



BASE FLASHING AT WOOD CURB (TORCH-APPLIED FLASHING SYSTEMS)

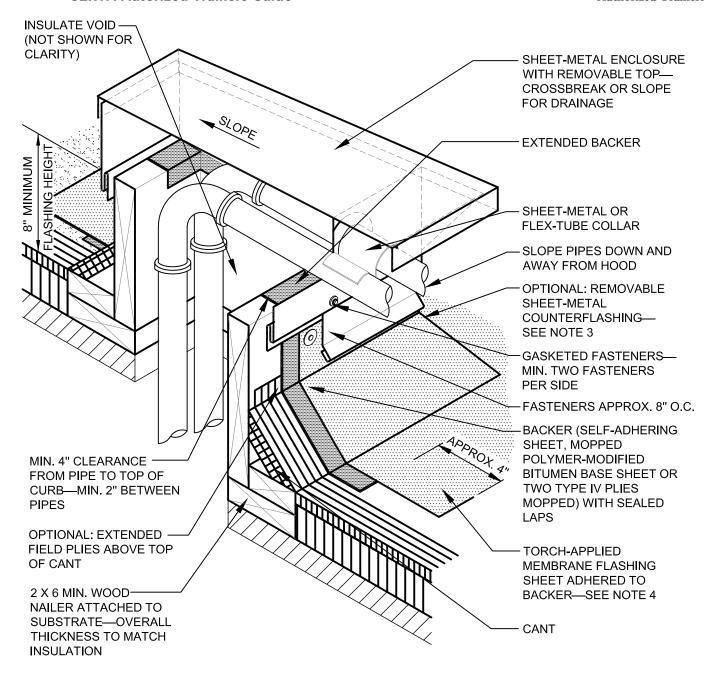


- THIS DETAIL ILLUSTRATES ONE METHOD OF ELIMINATING PENETRATION POCKETS. THE CURBED SYSTEM ALLOWS FOR MOVEMENT IN THE STRUCTURAL MEMBER WITHOUT DISTURBING THE ROOF SYSTEM.
- PENETRATIONS USING H, I AND C BEAMS/CHANNELS SHOULD BE AVOIDED. SQUARE OR ROUND TUBES ARE PREFERABLE.
- WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (50,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR COUNTERFLASHINGS.
- REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



BASE FLASHING AT STRUCTURAL MEMBER THROUGH ROOF DECK (TORCH-APPLIED FLASHING SYSTEMS)

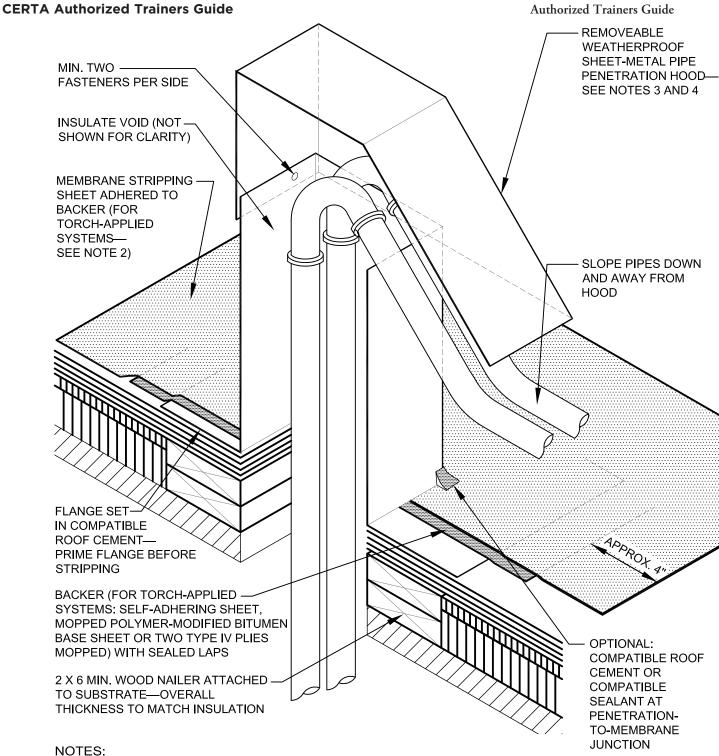
2023 **BUR(T)-14** NOT DRAWN TO SCALE



- THIS DETAIL ILLUSTRATES ANOTHER METHOD OF ELIMINATING PITCH POCKETS AND AN OPTIONAL METHOD OF GROUPING PIPING THAT MUST PENETRATE THE ROOF.
- MANY MANUFACTURERS OFFER PREFABRICATED BOOTS AND OTHER MATERIALS FOR THIS PURPOSE. SPECIFICS ABOUT THESE
 PROPRIETARY DESIGNS VARY GREATLY, AND INDIVIDUAL MANUFACTURERS' SPECIFICATIONS SHOULD BE CONSULTED FOR THEIR USE.
- 3. WHERE THE SHEET-METAL ENCLOSURE OVERLAPS THE BASE FLASHING AT LEAST 3 INCHES, THE REMOVABLE SHEET-METAL COUNTEREL ASHING IS NOT REQUIRED.
- 4. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 5. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



BASE FLASHING AT SHEET-METAL ENCLOSURE FOR PIPING THROUGH ROOF DECK (TORCH-APPLIED FLASHING SYSTEMS)

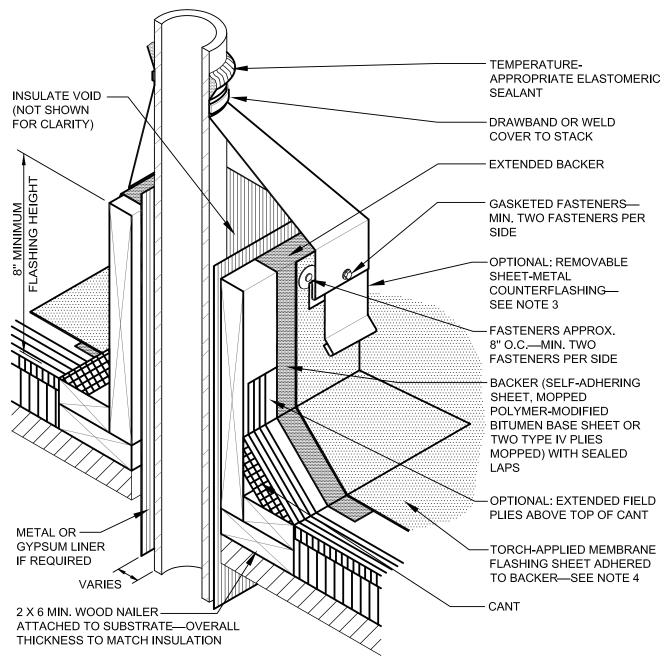


- THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR PIPE PENETRATION HOODS.
- REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



BASE FLASHING AT SHEET-METAL HOOD FOR PIPING THROUGH ROOF DECK (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)

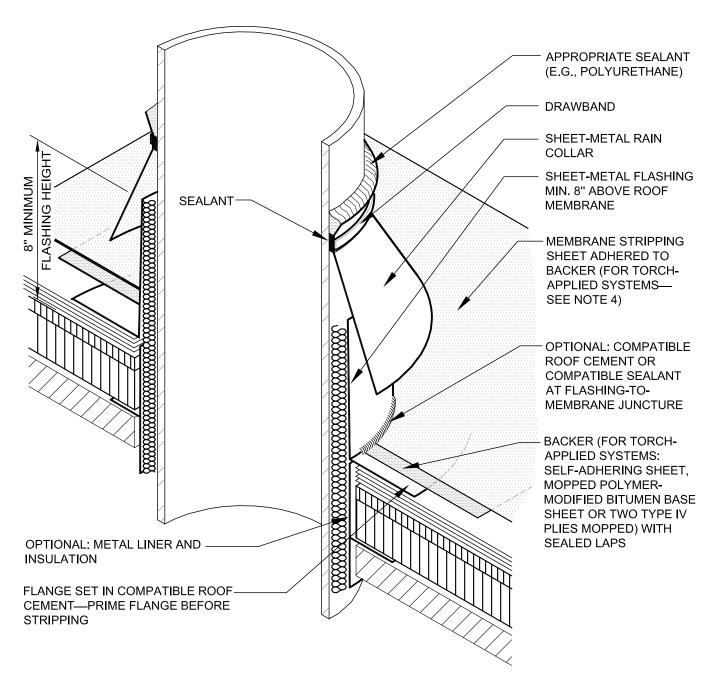
2023 **BUR-16** NOT DRAWN TO SCALE



- 1. THIS DETAIL ALLOWS THE OPENING TO BE COMPLETED BEFORE THE STACK IS PLACED.
- THE CLEARANCE NECESSARY BETWEEN THE OPTIONAL GYPSUM OR METAL LINER AND THE STACK AND THE NEED FOR INSULATION WILL DEPEND ON THE TEMPERATURE OF THE MATERIAL HANDLED BY THE STACK.
- WHERE THE ISOLATED STACK COVER OVERLAPS THE BASE FLASHING AT LEAST 3 INCHES, THE REMOVABLE SHEET-METAL
 COUNTERFLASHING IS NOT REQUIRED.
- 4. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 5. REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR COUNTERFLASHINGS.
- 6. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



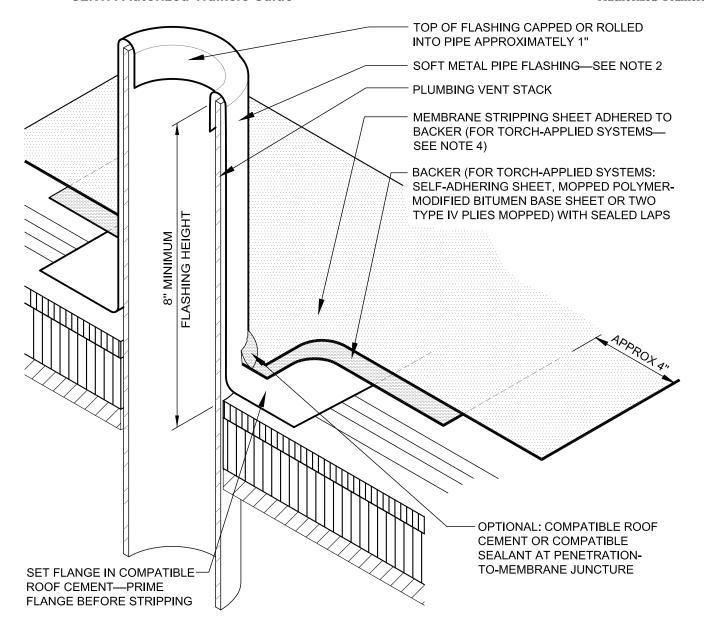
BUR(T)-17



- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2. THIS DETAIL ALLOWS THE OPENING TO BE COMPLETED BEFORE THE STACK IS PLACED.
- 3. THE CLEARANCE NECESSARY BETWEEN THE OPTIONAL INSULATION AND METAL LINER AND THE STACK WILL DEPEND ON THE TEMPERATURE OF THE MATERIAL HANDLED BY THE STACK.
- 4. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (50,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 5. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



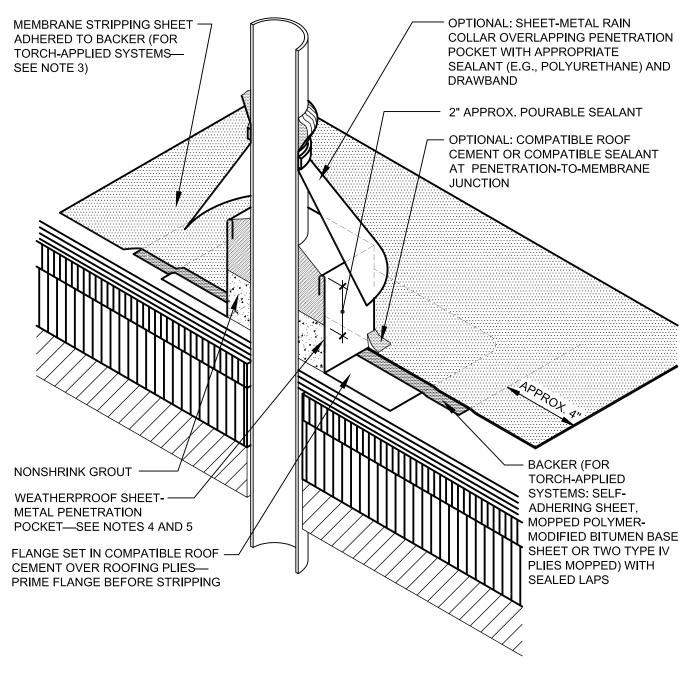
SHEET-METAL STACK VENT [HOT OR COLD] (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)



- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2. SOFT METAL PIPE FLASHING:
 - -SHEET LEAD: MINIMUM OF 2 1/2 LBS. PER SQUARE FOOT OR -SHEET COPPER: MINIMUM 16 OZ.
- PRECAUTIONS SHOULD BE TAKEN NOT TO DAMAGE THE SHEET LEAD WHEN USING HEAT-WELDED APPLICATION.
- 3. IF USING COPPER FLASHING OVER AN IRON OR STEEL PIPE, INSERT A SEPARATOR SHEET (E.G., ASPHALT-SATURATED ROOFING FELT) WRAPPED AROUND PIPE TO SEPARATE THE COPPER FLASHING FROM DIRECT CONTACT WITH PIPE TO REDUCE GALVANIC ACTION.
- 4. VENT STACKS AND OTHER PIPES SHOULD HAVE A MINIMUM OF 12 INCHES OF CLEARANCE ON ALL SIDES FROM WALLS, CURBS AND OTHER PROJECTIONS TO FACILITATE PROPER FLASHING. SEE THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.
- 5. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 6. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



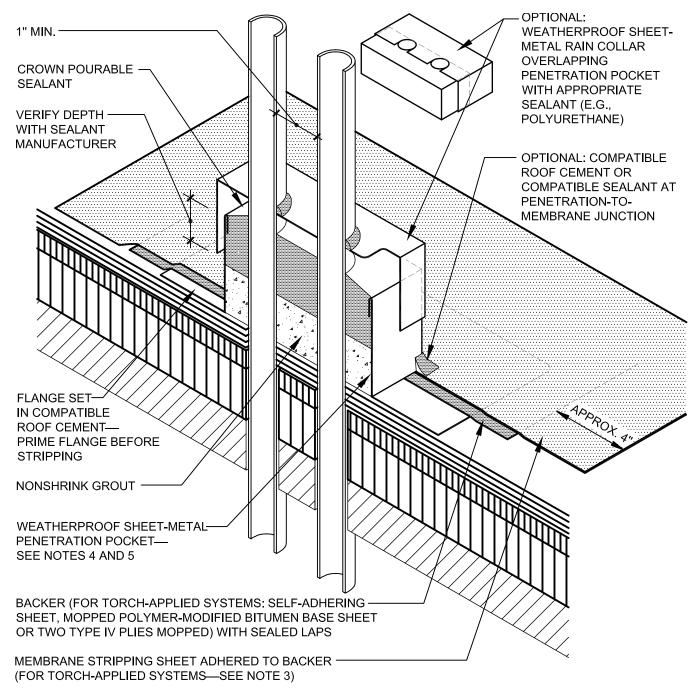
PLUMBING VENT (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)



- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2. PENETRATION POCKETS ARE NOT THE PREFERRED FLASHING METHOD AT THE PENETRATIONS BECAUSE THEY MAY BE A MAINTENANCE PROBLEM. SEE DETAIL BUR(L)-20 FOR THE PREFERRED FLASHING METHOD.
- 3. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 4. REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR PENETRATION POCKETS.
- 5. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



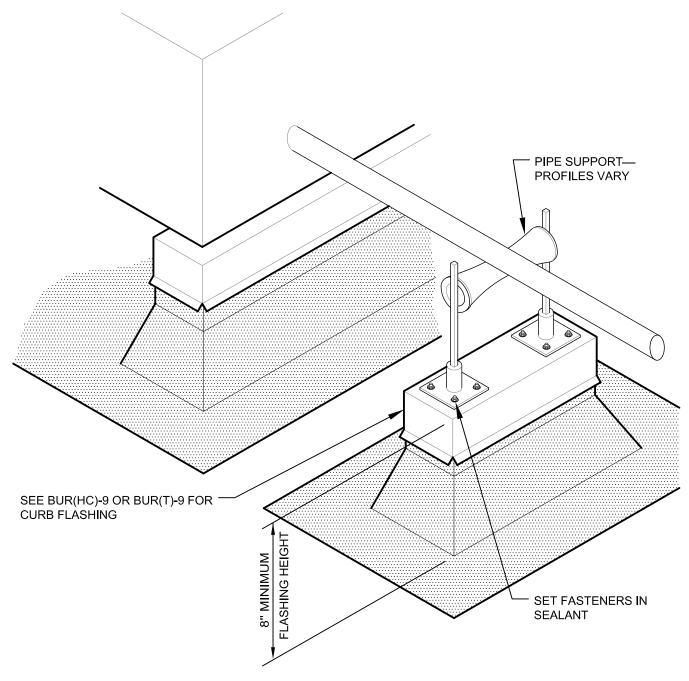
PENETRATION POCKET—SINGLE PENETRATION (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)



- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- PENETRATION POCKETS ARE NOT THE PREFERRED FLASHING METHOD AT THE PENETRATIONS BECAUSE THEY MAY BE A MAINTENANCE PROBLEM.
- 3. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 4. REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR PENETRATION POCKETS.
- 5. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



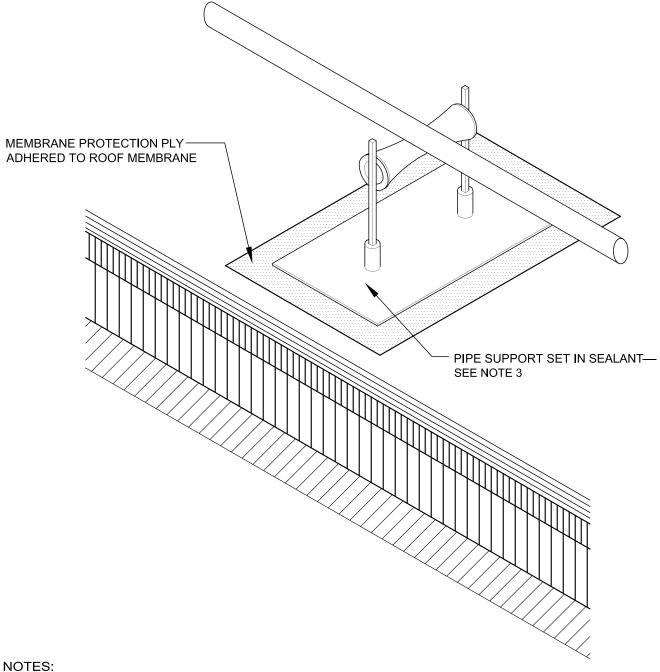
PENETRATION POCKET—DOUBLE PENETRATION (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)



- THIS DETAIL IS DESIGNED TO ELIMINATE ROOF DAMAGE RESULTING FROM EXPANSION AND CONTRACTION OF PIPES. PIPE SUPPORT PROFILES VARY.
- 2. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 3. REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR SHEET-METAL COVERS.
- 4. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



PIPE SUPPORT CURB (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)

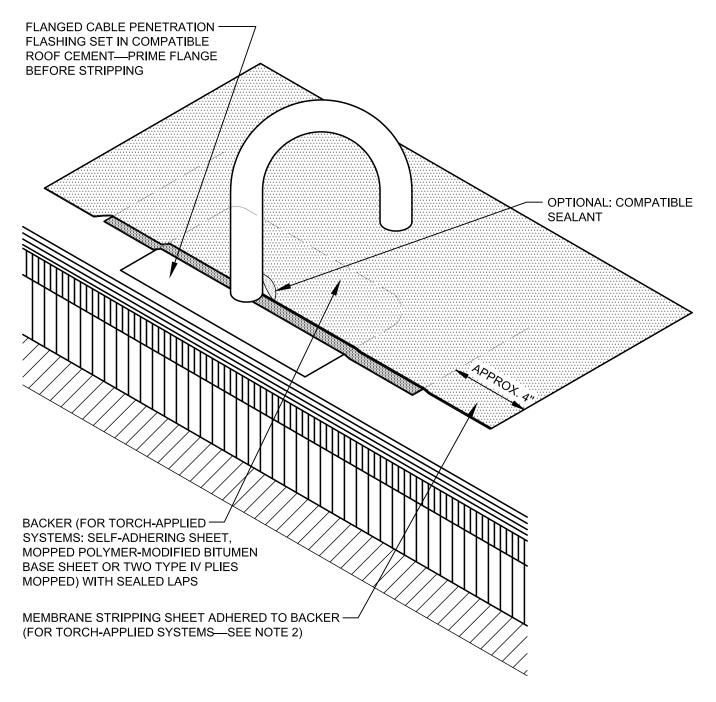


- THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- THIS DETAIL IS DESIGNED TO ELIMINATE ROOF DAMAGE RESULTING FROM EXPANSION AND CONTRACTION OF PIPES.
- PIPE SUPPORT PROFILES VARY. REFER TO THE MANUFACTURER FOR LOAD CAPACITY AND RECOMMENDED SPACING OF SUPPORTS.
- REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



PIPE SUPPORT (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)

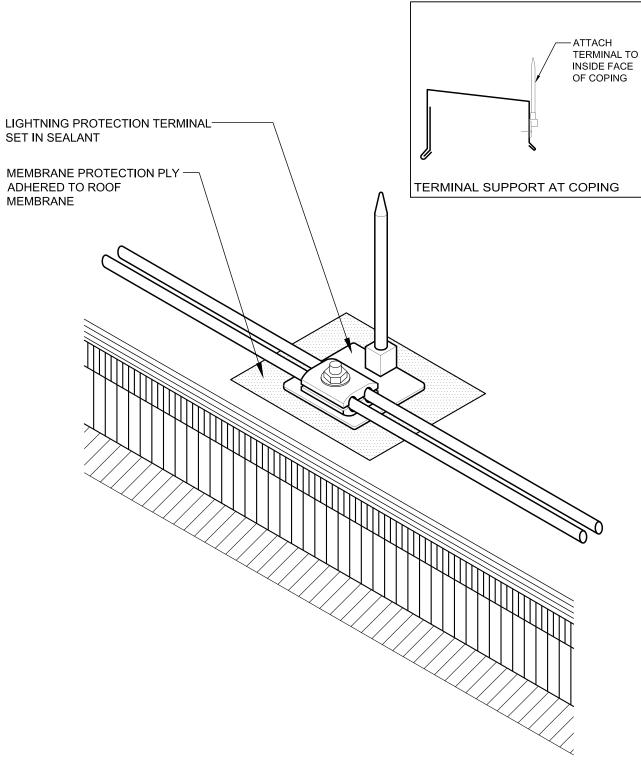
2023 **BUR-22A** NOT DRAWN TO SCALE



- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2. DETAIL DEPICTS THE WEATHERPROOFING PROTECTION AND DOES NOT REPRESENT LIGHTNING PROTECTION DESIGN.
- 3. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 4. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



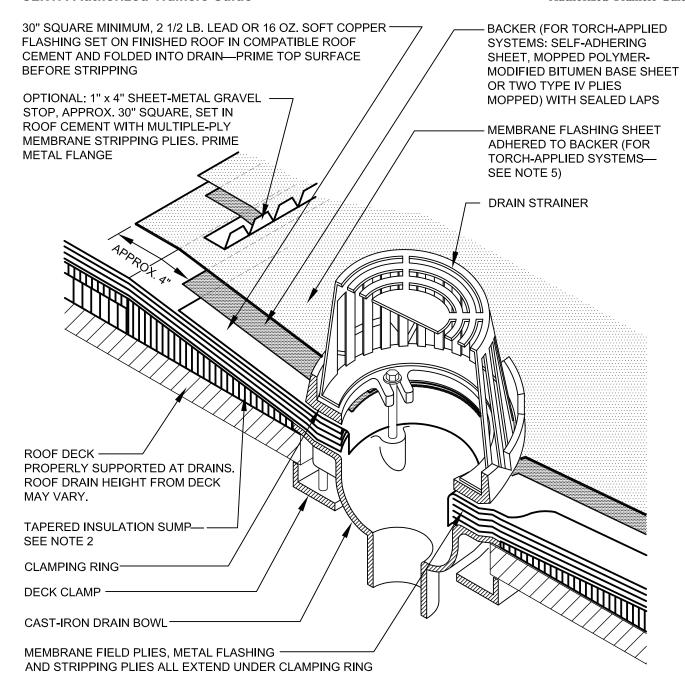
CABLE PENETRATION (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)



- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2. DETAIL DEPICTS THE WEATHERPROOFING PROTECTION AND DOES NOT REPRESENT LIGHTNING PROTECTION DESIGN.
- 3. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



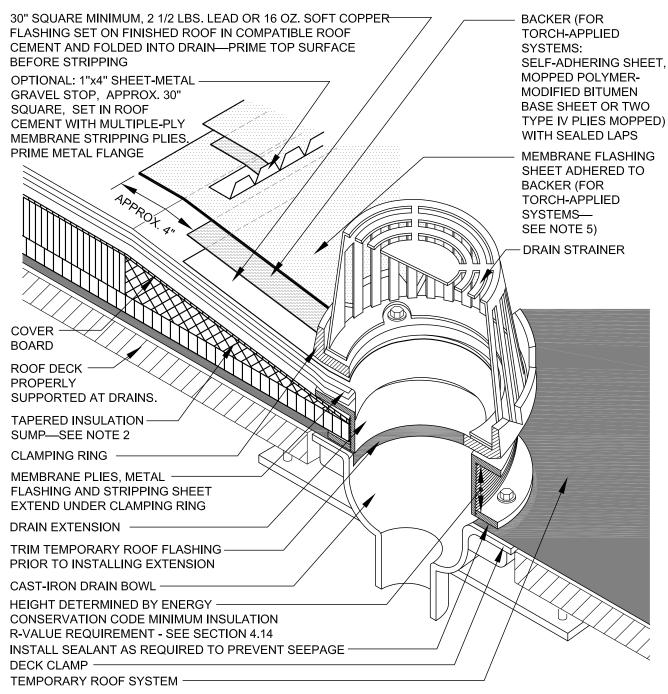
LIGHTNING PROTECTION TERMINAL (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)



- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2. THE USE OF A METAL DECK SUMP PAN IS NOT RECOMMENDED. HOWEVER, DRAIN RECEIVER/BEARING PLATES ARE APPLICABLE WITH SOME PROJECTS.
- 3. DO NOT APPLY COAL TAR OR DEAD-LEVEL ASPHALT INTO DRAIN SUMP.
- 4. THE DESIGNER SHOULD CONSIDER INSULATING THE DRAIN COMPONENTS BELOW THE DECK TO PREVENT POTENTIAL CONDENSATION.
- 5. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 6. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



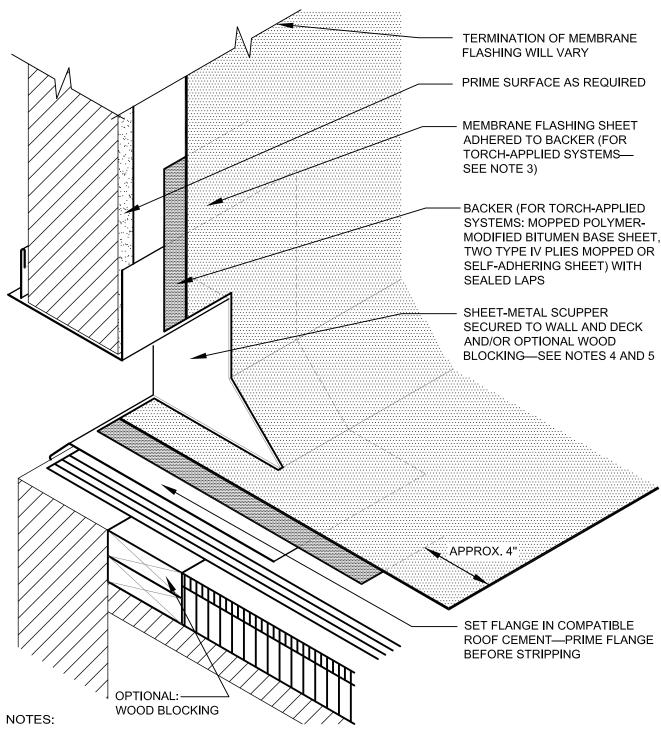
ROOF DRAIN (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)



- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS
- 2. THE USE OF A METAL DECK SUMP PAN IS NOT RECOMMENDED. HOWEVER, DRAIN RECEIVER/BEARING PLATES ARE APPLICABLE WITH SOME PROJECTS.
- 3 DO NOT APPLY COAL TAR OR DEAD-LEVEL ASPHALT INTO DRAIN SUMP.
- 4. THE DESIGNER SHOULD CONSIDER INSULATING THE DRAIN COMPONENTS BELOW THE DECK TO PREVENT POTENTIAL CONDENSATION.
- 5. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 6. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



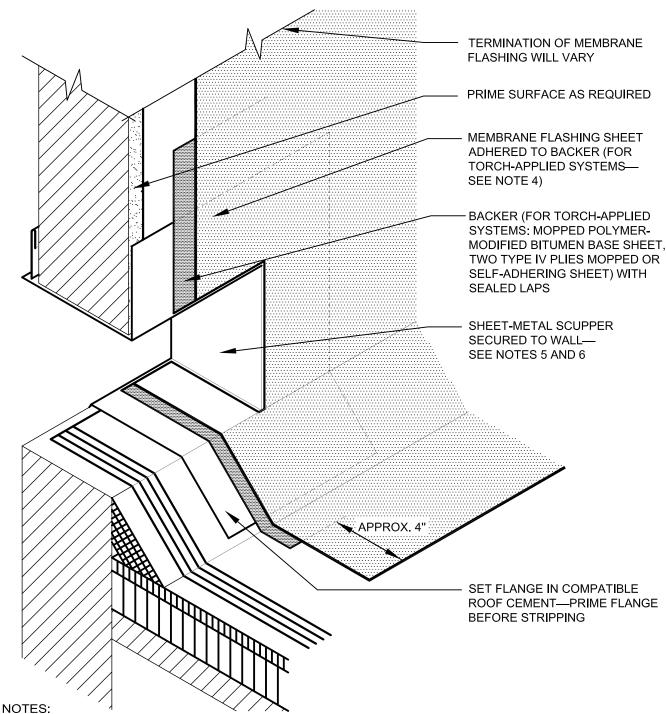
ROOF DRAIN WITH EXTENSION AND TEMPORARY ROOF SYSTEM (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)



- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2. THIS DETAIL DOES NOT ALLOW FOR DIFFERENTIAL MOVEMENT BETWEEN THE DECK AND WALL.
- 3. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 4. REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR SCUPPERS.
- 5. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



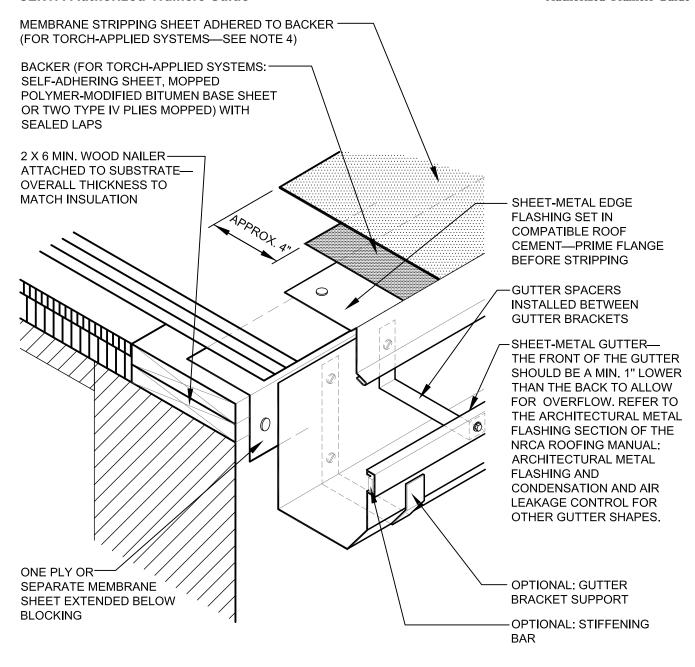
THROUGH-WALL SCUPPER (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)



- THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2. THIS DETAIL DOES NOT ALLOW FOR DIFFERENTIAL MOVEMENT BETWEEN THE DECK AND WALL.
- 3. ELEVATION OF SCUPPER MAY VARY.
- 4. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR SCUPPERS.
- 6. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



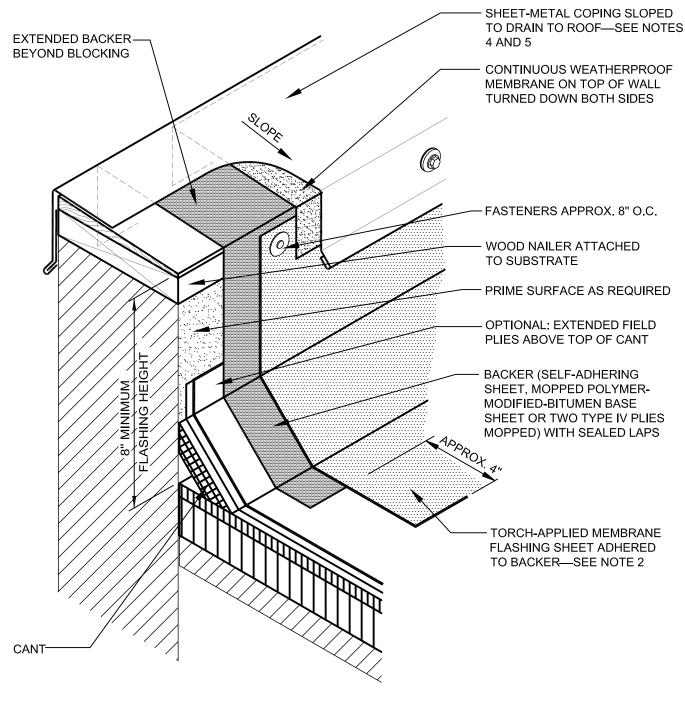
OVERFLOW SCUPPER (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)



- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2. IN CLIMATES WHERE THE WINTER TEMPERATURE REMAINS BELOW FREEZING FOR EXTENDED PERIODS OF TIME, NRCA SUGGESTS USING INTERIOR DRAINS TO DRAIN THE ROOF.
- 3. GUTTER BRACKETS ARE RECOMMENDED TO BE AT LEAST ONE GAUGE HEAVIER THAN GUTTER STOCK.
- 4. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOPAPPLICATION METHOD.
- 5. REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR GUTTERS.
- 6. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



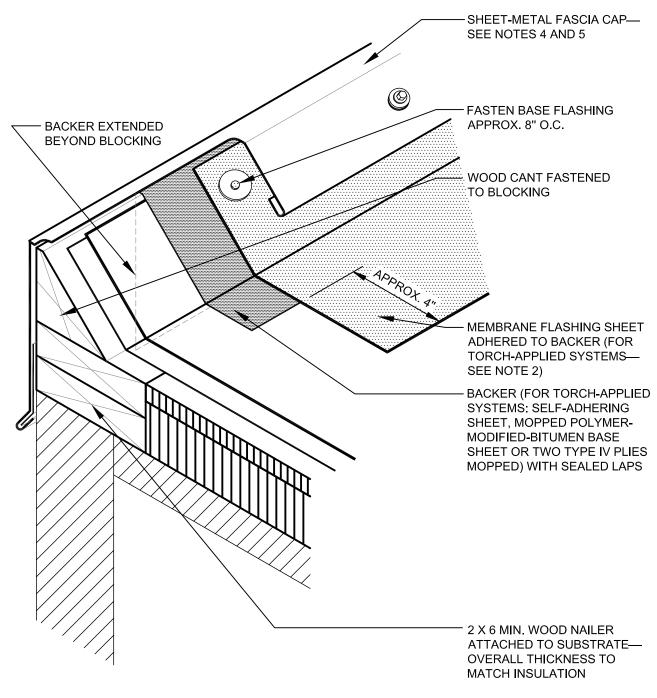
GUTTER WITH PERIMETER EDGE METAL (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)



- 1. THIS DETAIL DOES NOT ALLOW FOR DIFFERENTIAL MOVEMENT BETWEEN THE DECK AND WALL. SEE DETAIL MB(T)-7 FOR EXPANSION JOINT AT DECK-TO-WALL LOCATION.
- 2. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 3. FOR ROOF SYSTEMS WITH FACTORY-APPLIED GRANULE SURFACING, PROPERLY PREPARE CAP SHEET TO RECEIVE FLASHING.
- 4. REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR COPINGS.
- 5. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



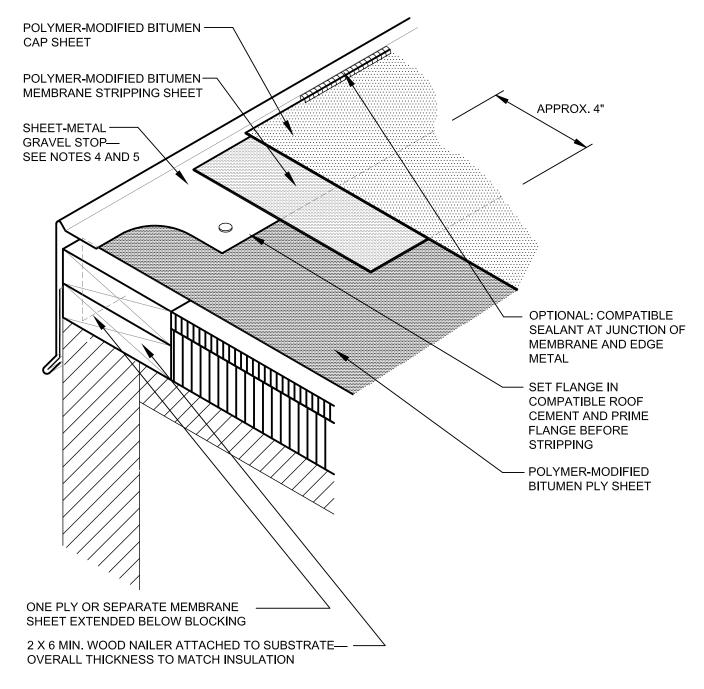
BASE FLASHING AT PARAPET WALL WITH METAL COPING (TORCH-APPLIED FLASHING SYSTEMS)



- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED SYSTEMS.
- 2. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 3. FOR ROOF SYSTEMS WITH FACTORY-APPLIED GRANULE SURFACING, PROPERLY PREPARE CAP SHEET TO RECEIVE FLASHING.
- 4. REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR FASCIA CAPS.
- ${\tt 5.}~{\tt REFER}~{\tt TO}~{\tt THE}~{\tt INTRODUCTION}~{\tt OF}~{\tt THE}~{\tt CONSTRUCTION}~{\tt DETAILS}~{\tt CHAPTER}~{\tt FOR}~{\tt ADDITIONAL}~{\tt INFORMATION}.$



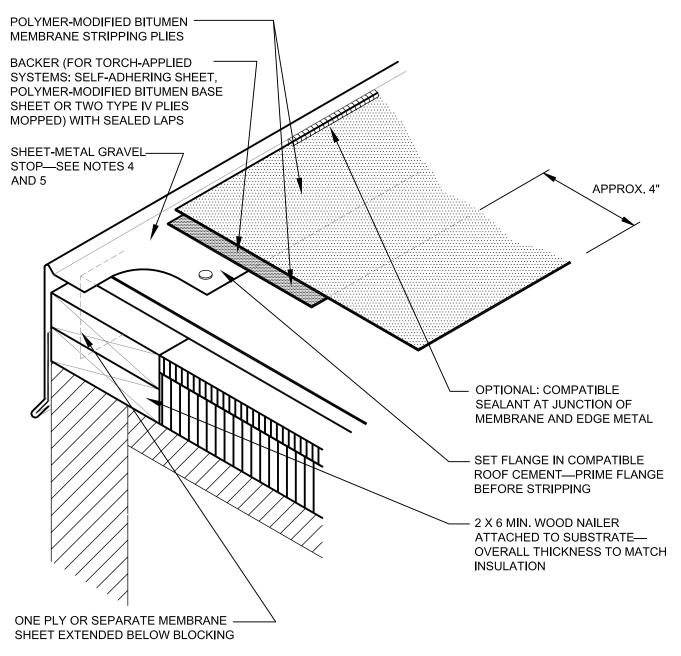
RAISED PERIMETER EDGE WITH METAL FLASHING [FASCIA CAP] (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)



- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 3. FOR ROOF SYSTEMS WITH FACTORY-APPLIED GRANULE SURFACING, PROPERLY PREPARE CAP SHEET TO RECEIVE FLASHING.
- 4. REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR GRAVEL STOPS.
- 5. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



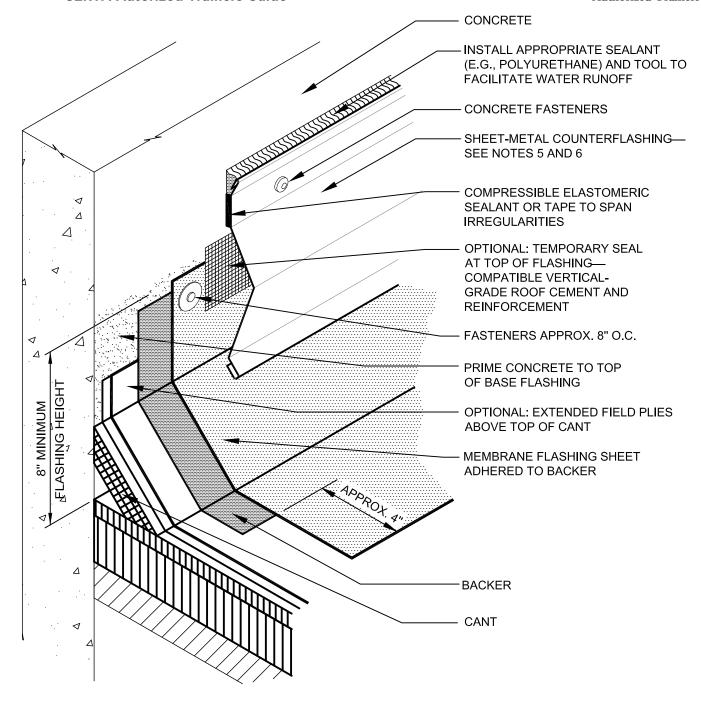
EMBEDDED EDGE-METAL FLASHING [GRAVEL STOP] (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)



- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 3. FOR ROOF SYSTEMS WITH FACTORY-APPLIED GRANULE SURFACING, PROPERLY PREPARE CAP SHEET TO RECEIVE FLASHING.
- 4. REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR GRAVEL STOPS.
- 5. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



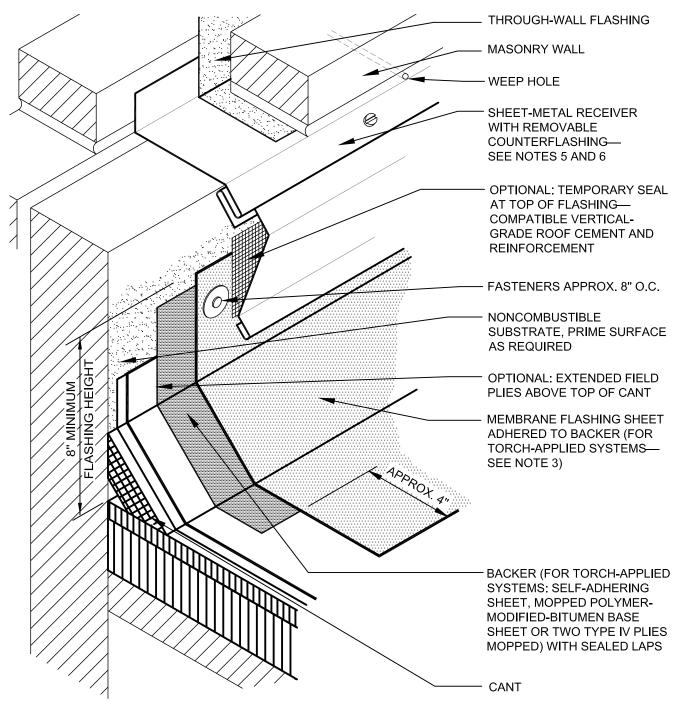
EMBEDDED EDGE-METAL FLASHING [GRAVEL STOP] (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)



- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2. THIS DETAIL DOES NOT ALLOW FOR DIFFERENTIAL MOVEMENT BETWEEN THE DECK AND WALL.
- 3. COUNTERFLASHING DETAIL MAY BE A TWO-PIECE REGLET AND COUNTERFLASHING (SEE THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR SHEET-METAL COUNTERFLASHING OPTIONS).
- 4. FOR ROOF SYSTEMS WITH FACTORY-APPLIED GRANULE SURFACING, PROPERLY PREPARE CAP SHEET TO RECEIVE FLASHING.
- 5. REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR COUNTERFLASHINGS.
- 6. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



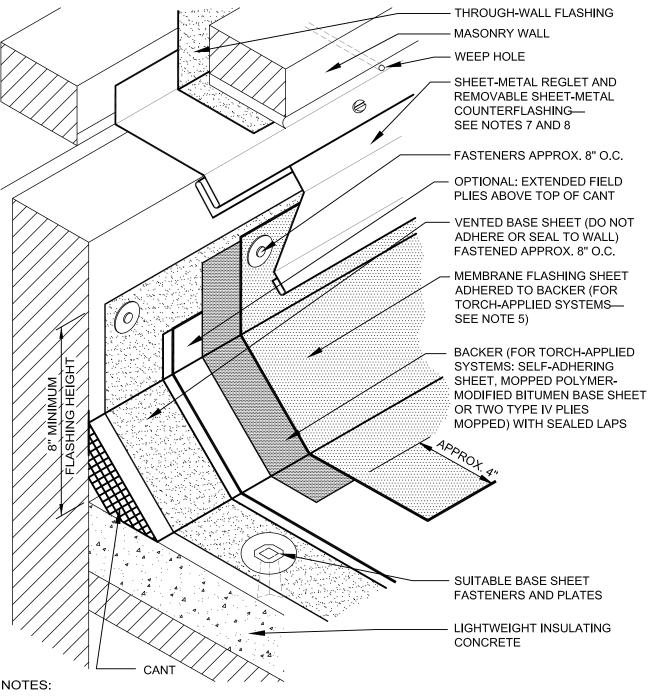
BASE FLASHING WITH SURFACE-MOUNTED COUNTERFLASHING AT CONCRETE WALL (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)



- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2. THIS DETAIL DOES NOT ALLOW FOR DIFFERENTIAL MOVEMENT BETWEEN THE DECK AND WALL.
- 3. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 4. FOR ROOF SYSTEMS WITH FACTORY-APPLIED GRANULE SURFACING, PROPERLY PREPARE CAP SHEET TO RECEIVE FLASHING.
- 5. REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR COUNTERFLASHINGS.
- 6. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



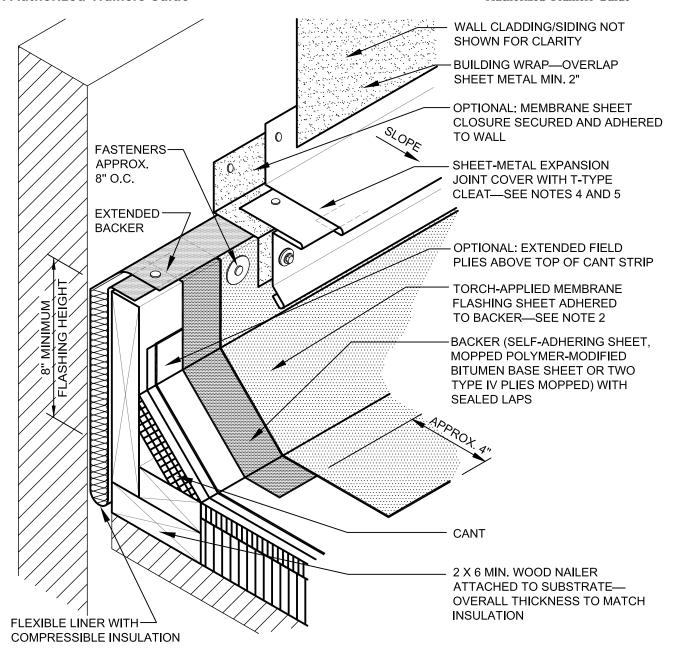
BASE FLASHING WITH TWO-PIECE SHEET-METAL COUNTERFLASHING (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)



- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2. THIS DETAIL IS TO BE USED OVER WET-FILL DECKS (E.G., LIGHTWEIGHT INSULATING CONCRETE).
- 3. THIS DETAIL DOES NOT ALLOW FOR DIFFERENTIAL MOVEMENT BETWEEN THE DECK AND WALL.
- 4. ALL PLIES ARE TO BE SOLIDLY MOPPED TO THE BASE SHEET. CARE SHOULD BE USED NOT TO ADHERE THE BASE SHEET TO THE WALL.
- 5. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 6. FOR ROOF SYSTEMS WITH FACTORY-APPLIED GRANULE SURFACING, PROPERLY PREPARE CAP SHEET TO RECEIVE FLASHING.
- 7. REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR COUNTERFLASHINGS.
- 8. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



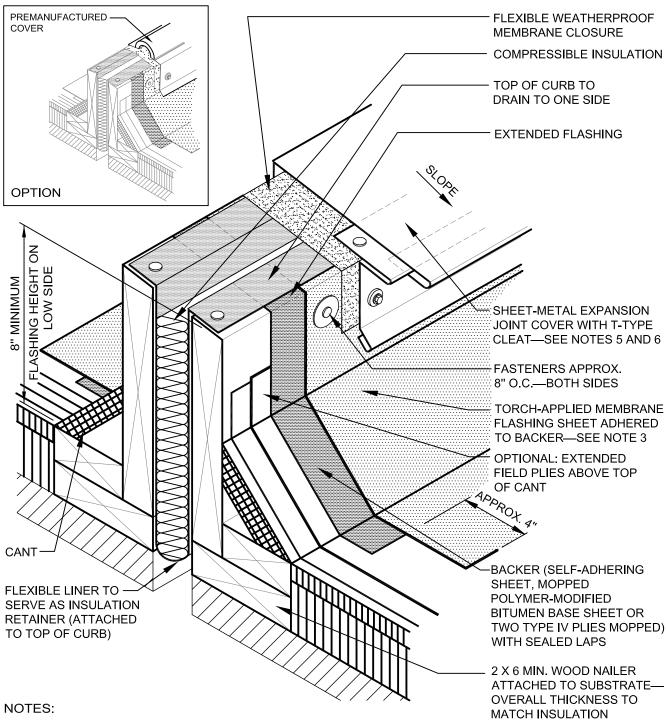
BASE FLASHING WITH VENTED BASE SHEET (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)



- THIS DETAIL SHOULD BE USED WHEN THERE IS ANY POSSIBILITY DIFFERENTIAL MOVEMENT WILL OCCUR BETWEEN THE DECK AND A
 VERTICAL SURFACE. THE WOOD MEMBERS SHOULD NOT BE FASTENED TO THE WALL.
- 2. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 3. FOR ROOF SYSTEMS WITH FACTORY-APPLIED GRANULE SURFACING, PROPERLY PREPARE CAP SHEET TO RECEIVE FLASHING.
- 4. REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR COUNTERFLASHING.
- 5. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



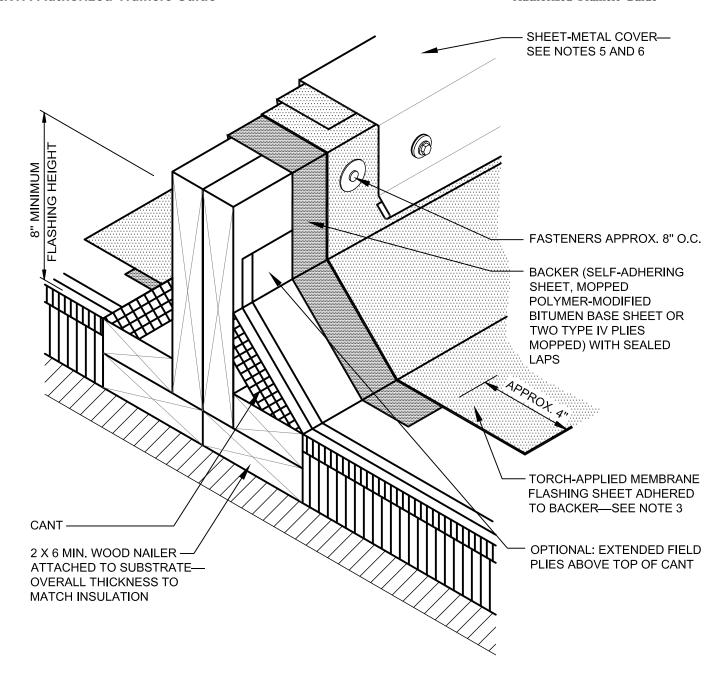
BASE FLASHING AT ROOF-TO-WALL EXPANSION JOINT (TORCH-APPLIED FLASHING SYSTEMS)



- 1. THIS DETAIL ALLOWS FOR BUILDING MOVEMENT IN MULTIPLE DIRECTIONS.
- 2. FLASHING REQUIREMENTS ARE TYPICAL FOR BOTH SIDES OF EXPANSION JOINT.
- 3. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 4. FOR ROOF SYSTEMS WITH FACTORY-APPLIED GRANULE SURFACING, PROPERLY PREPARE CAP SHEET TO RECEIVE FLASHING.
- 5. REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR EXPANSION JOINT COVERS.
- 6. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



BASE FLASHING AT EXPANSION JOINT WITH METAL COVER (TORCH-APPLIED FLASHING SYSTEMS)

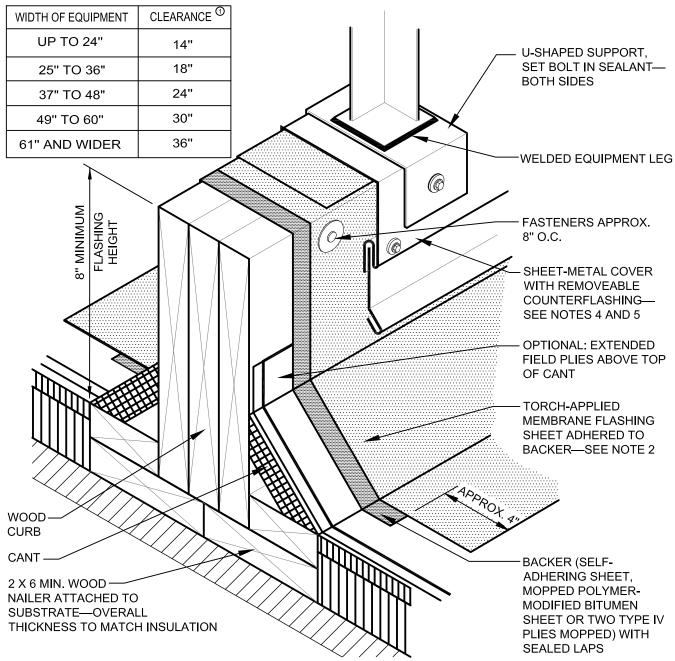


- AN AREA DIVIDER SHOULD NEVER RESTRICT THE FLOW OF WATER.
- 2. FLASHING REQUIREMENTS ARE TYPICAL FOR BOTH SIDES OF THE AREA DIVIDER.
- WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- FOR ROOF SYSTEMS WITH FACTORY-APPLIED GRANULE SURFACING, PROPERLY PREPARE CAP SHEET TO RECEIVE FLASHING.
- REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR SHEET-METAL COVERS. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



BASE FLASHING AT AREA DIVIDER IN ROOF SYSTEM (TORCH-APPLIED FLASHING SYSTEMS)

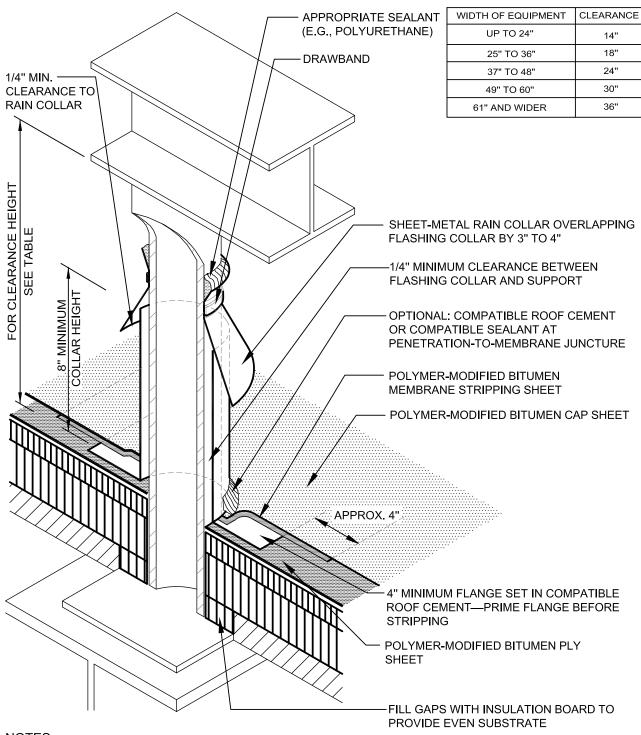
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- 1. THIS DETAIL ALLOWS FOR MEMBRANE MAINTENANCE AROUND THE SUPPORTED EQUIPMENT. THE CONTINUOUS SUPPORT IS PREFERRED IN LIGHTWEIGHT STRUCTURAL SYSTEMS BECAUSE THE EQUIPMENT WEIGHT CAN BE SPREAD ACROSS TWO OR MORE SUPPORTING MEMBERS. WHERE HEAVY STRUCTURAL SYSTEMS ARE USED OR WHERE THE LOAD CAN BE CONCENTRATED OVER A COLUMN, DETAIL MB-11 MAY BE PREFERRED. A MINIMUM OF 2 FEET OF HORIZONTAL CLEARANCE MUST BE PROVIDED FOR REMOVAL AND REPLACEMENT OF ROOFING AND FLASHING BETWEEN PARALLEL SUPPORTS. REFER TO THE TABLE ABOVE FOR RECOMMENDATIONS ON VERTICAL CLEARANCE FROM ROOF SURFACE TO THE BOTTOM OF SUPPORTED EQUIPMENT.
- 2. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 3. FOR ROOF SYSTEMS WITH FACTORY-APPLIED GRANULE SURFACING, PROPERLY PREPARE CAP SHEET TO RECEIVE FLASHING.
- 4. REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR SHEET-METAL COVERS.
- 5. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



BASE FLASHING AT EQUIPMENT SUPPORT CURB (TORCH-APPLIED FLASHING SYSTEMS)



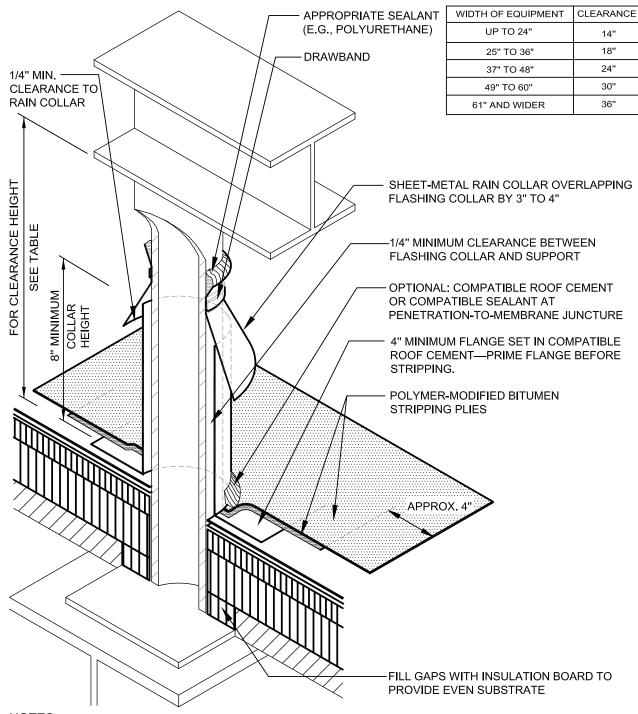
- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 3. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



EQUIPMENT SUPPORT STAND AND TYPICAL RAIN COLLAR PENETRATION (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)

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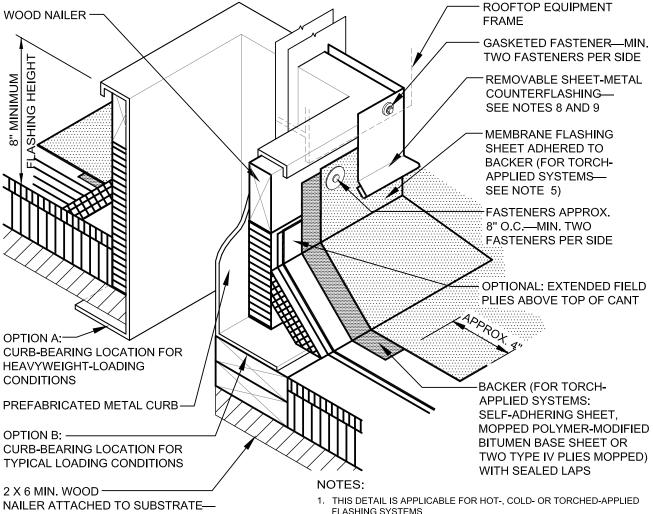
- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 3. FOR ROOF SYSTEMS WITH FACTORY-APPLIED GRANULE SURFACING, PROPERLY PREPARE CAP SHEET TO RECEIVE FLASHING.
- 4. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



EQUIPMENT SUPPORT STAND AND TYPICAL RAIN COLLAR PENETRATION (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)

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- NAILER ATTACHED TO SUBSTRATE—

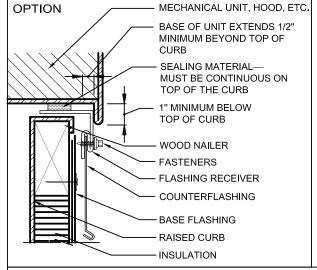
 OVERALL THICKNESS TO MATCH INSULATION

 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCHED-APPLIE
 FLASHING SYSTEMS.

 2. THE CURBS, TOP WOOD NAILER AND SEAL STRIP ARE TO BE
 - SUPPLIED BY THE CURB MANUFACTURER.

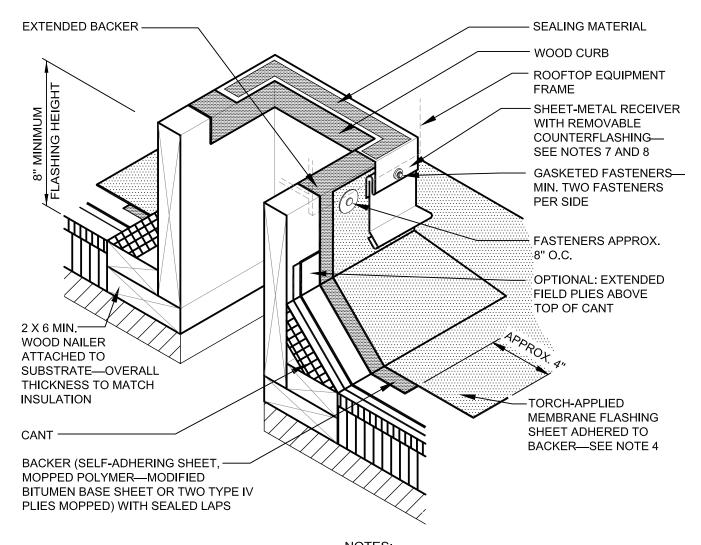
 3. WHEN POSSIBLE THE MECHANICAL LINITS SHOULD NOT BE SET LINTH.
 - THE ROOF MEMBRANE AND FLASHING HAVE BEEN INSTALLED.

 4. WHERE THE SKYLIGHT, SCUTTLE OR SMOKE VENT FRAME
 - OVERLAPS THE BASE FLASHING AT LEAST 3 INCHES, THE REMOVABLE SHEET-METAL COUNTERFLASHING IS NOT REQUIRED.
 - 5. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
 - 6. NRCA RECOMMENDS DESIGNERS CONSIDER PERMANENT INTERNAL OR EXTERNAL FALL-PROTECTION DEVICES AT ALL SKYLIGHTS.
 - 7. FOR ROOF SYSTEMS WITH FACTORY-APPLIED GRANULE SURFACING, PROPERLY PREPARE CAP SHEET TO RECEIVE FLASHING.
 - 8. REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR JOINERY AND SECUREMENT OPTIONS FOR SHEET-METAL FLASHINGS.
 - 9. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.

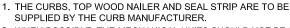


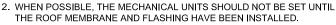


BASE FLASHING AT PREFABRICATED METAL CURB (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)

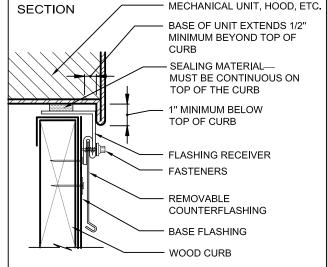






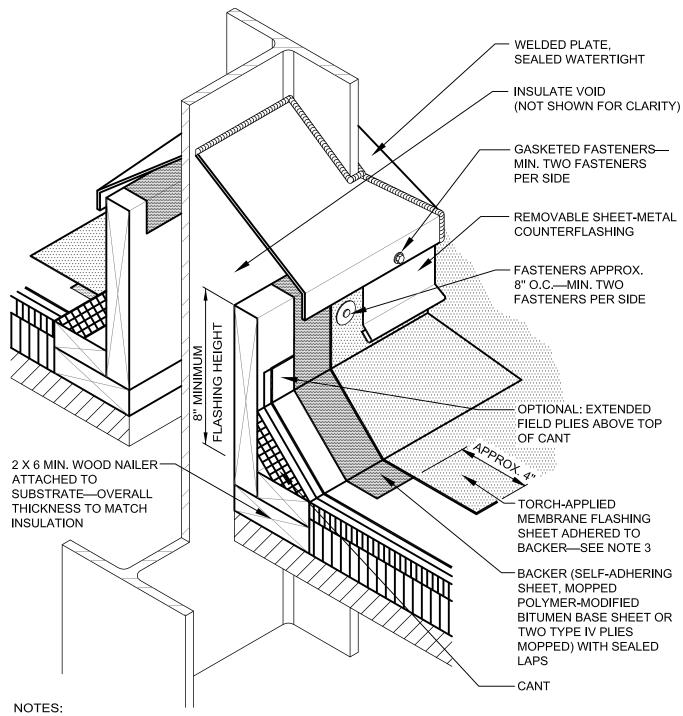


- 3. WHERE THE SKYLIGHT, SCUTTLE OR SMOKE VENT FRAME OVERLAPS THE BASE FLASHING AT LEAST 3 INCHES, THE REMOVABLE SHEET-METAL COUNTERFLASHING IS NOT REQUIRED.
- 4. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 5. FOR ROOF SYSTEMS WITH FACTORY-APPLIED GRANULE SURFACING, PROPERLY PREPARE CAP SHEET TO RECEIVE FLASHING.
- 6. NRCA RECOMMENDS DESIGNERS CONSIDER PERMANENT INTERNAL OR EXTERNAL FALL-PROTECTION DEVICES AT ALL SKYLIGHTS.
- 7. REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR SHEET-METAL FLASHING.
- REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.





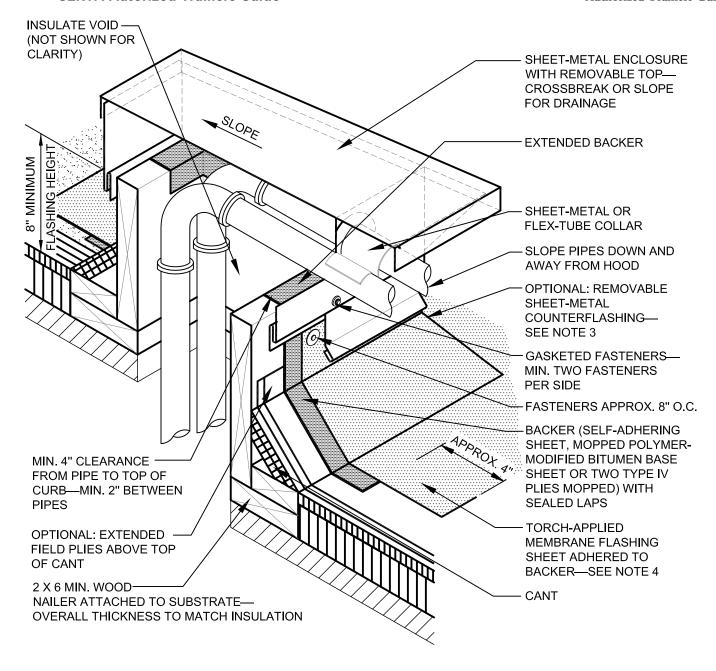
BASE FLASHING AT WOOD CURB (TORCH-APPLIED FLASHING SYSTEMS)



- 1. THIS DETAIL ILLUSTRATES ONE METHOD OF ELIMINATING PENETRATION POCKETS. THE CURBED SYSTEM ALLOWS FOR MOVEMENT IN THE STRUCTURAL MEMBER WITHOUT DISTURBING THE ROOF SYSTEM.
- 2. PENETRATIONS USING H, I AND C BEAMS/CHANNELS SHOULD BE AVOIDED. SQUARE OR ROUND TUBES ARE PREFERABLE.
- 3. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 4. FOR ROOF SYSTEMS WITH FACTORY-APPLIED GRANULE SURFACING, PROPERLY PREPARE CAP SHEET TO RECEIVE FLASHING.
- 5. REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR SHEET-METAL FLASHING.
- 6. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



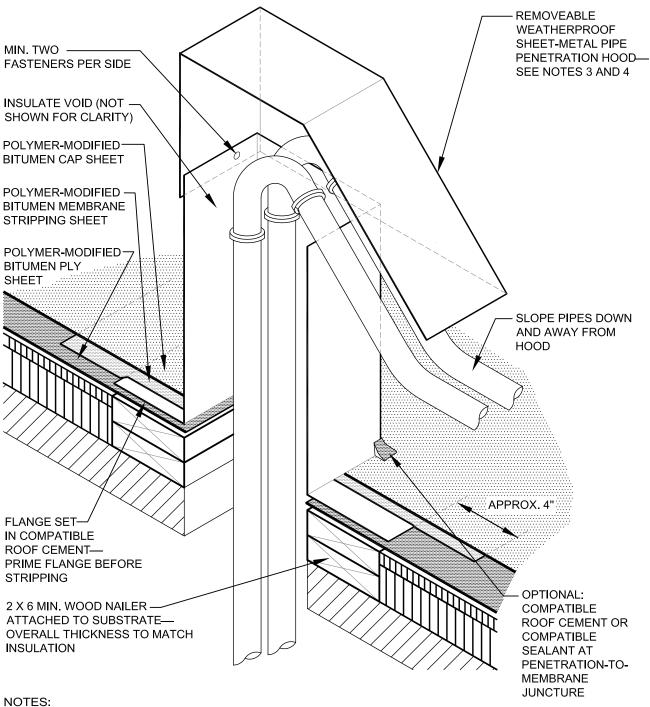
BASE FLASHING AT STRUCTURAL MEMBER THROUGH ROOF DECK (TORCH-APPLIED FLASHING SYSTEMS)



- 1. THIS DETAIL ILLUSTRATES ANOTHER METHOD OF ELIMINATING PITCH POCKETS AND AN OPTIONAL METHOD OF GROUPING PIPING THAT MUST PENETRATE THE ROOF.
- 2. MANY MANUFACTURERS OFFER PREFABRICATED BOOTS AND OTHER MATERIALS FOR THIS PURPOSE. SPECIFICS ABOUT THESE PROPRIETARY DESIGNS VARY GREATLY, AND INDIVIDUAL MANUFACTURERS' SPECIFICATIONS SHOULD BE CONSULTED FOR THEIR USE.
- WHERE THE SHEET-METAL ENCLOSURE OVERLAPS THE BASE FLASHING AT LEAST 3 INCHES, THE REMOVABLE SHEET-METAL COUNTERFLASHING IS NOT REQUIRED.
- 4. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 5. FOR ROOF SYSTEMS WITH FACTORY-APPLIED GRANULE SURFACING, PROPERLY PREPARE CAP SHEET TO RECEIVE FLASHING.
- 6. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



BASE FLASHING AT SHEET-METAL ENCLOSURE FOR PIPING THROUGH ROOF DECK (TORCH-APPLIED FLASHING SYSTEMS)

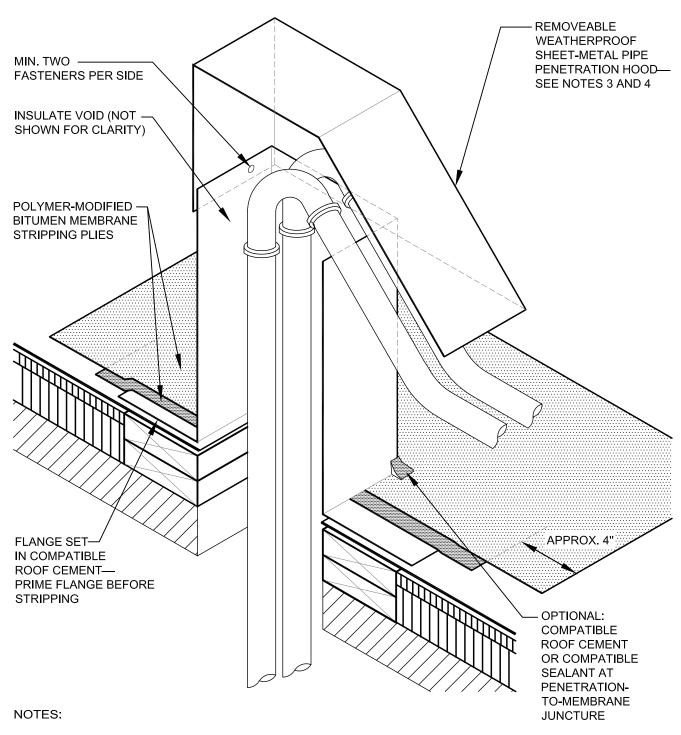


- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR PIPE PENETRATION HOODS.
- REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



BASE FLASHING AT SHEET-METAL HOOD FOR PIPING THROUGH ROOF DECK (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)

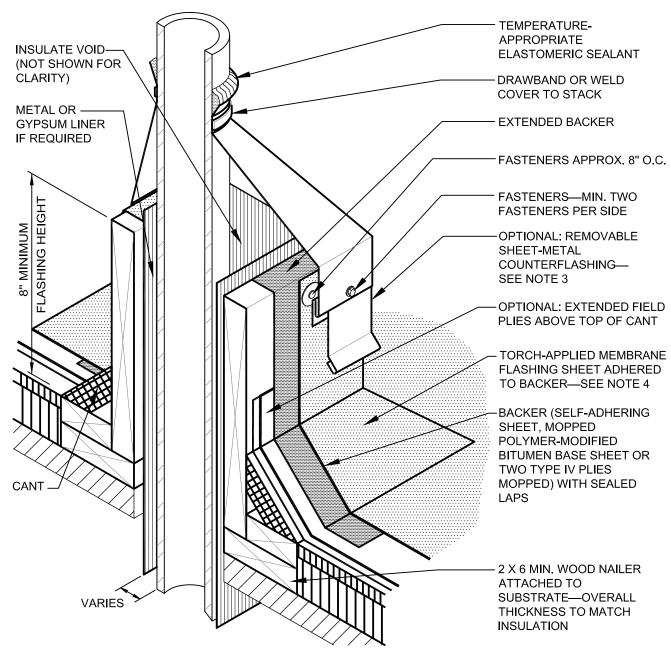
2023 **MB-16** NOT DRAWN TO SCALE



- . THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
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- 4. REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR PIPE PENETRATION HOODS.
- 5. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



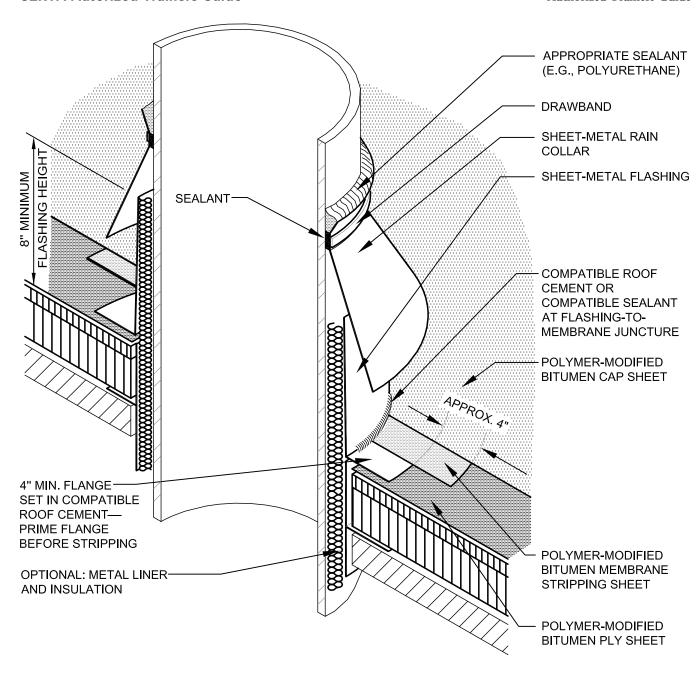
BASE FLASHING AT SHEET-METAL HOOD FOR PIPING THROUGH ROOF DECK (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)



- 1. THIS DETAIL ALLOWS THE OPENING TO BE COMPLETED BEFORE THE STACK IS PLACED.
- THE CLEARANCE NECESSARY BETWEEN THE OPTIONAL GYPSUM OR METAL LINER AND THE STACK AND THE NEED FOR INSULATION WILL DEPEND ON THE TEMPERATURE OF THE MATERIAL HANDLED BY THE STACK.
- 3. WHERE THE ISOLATED STACK COVER OVERLAPS THE BASE FLASHING AT LEAST 3 INCHES, THE REMOVABLE SHEET-METAL COUNTERFLASHING IS NOT REQUIRED.
- 4. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
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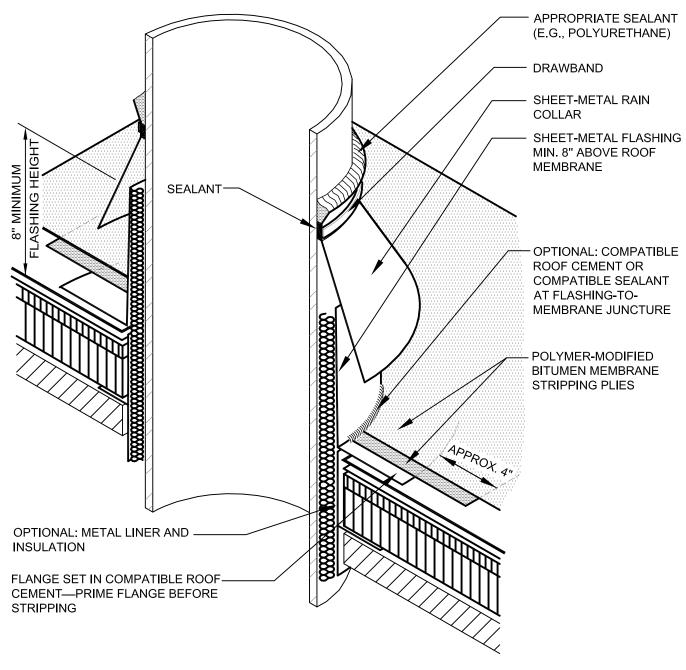
BASE FLASHING AT STACK VENT WITH CURB [HOT OR COLD] (TORCH-APPLIED FLASHING SYSTEMS)



- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- THIS DETAIL ALLOWS THE OPENING TO BE COMPLETED BEFORE THE STACK IS PLACED.
- THE CLEARANCE NECESSARY BETWEEN THE OPTIONAL INSULATION AND METAL LINER AND THE STACK WILL DEPEND ON THE TEMPERATURE OF THE MATERIAL HANDLED BY THE STACK.
- 4. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 5. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



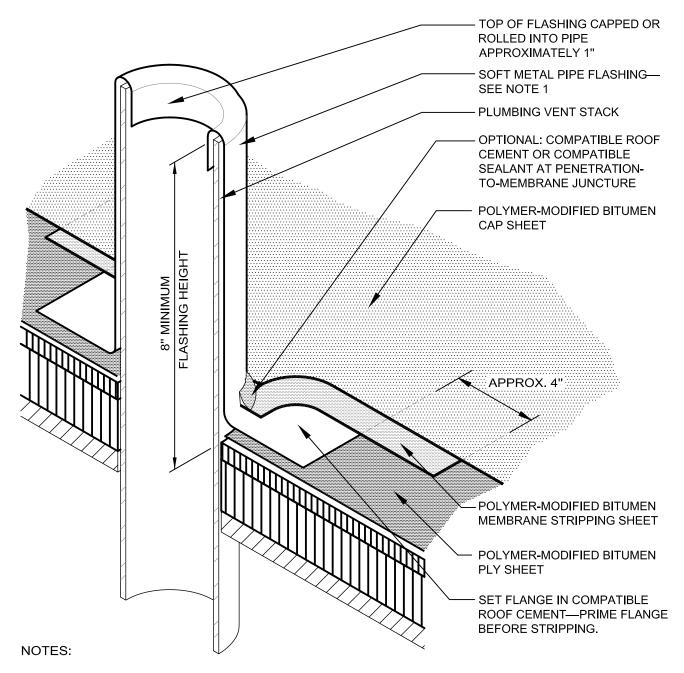
SHEET-METAL STACK VENT [HOT OR COLD] (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)



- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2. THIS DETAIL ALLOWS THE OPENING TO BE COMPLETED BEFORE THE STACK IS PLACED.
- 3. THE CLEARANCE NECESSARY BETWEEN THE OPTIONAL INSULATION AND METAL LINER AND THE STACK WILL DEPEND ON THE TEMPERATURE OF THE MATERIAL HANDLED BY THE STACK.
- 4. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
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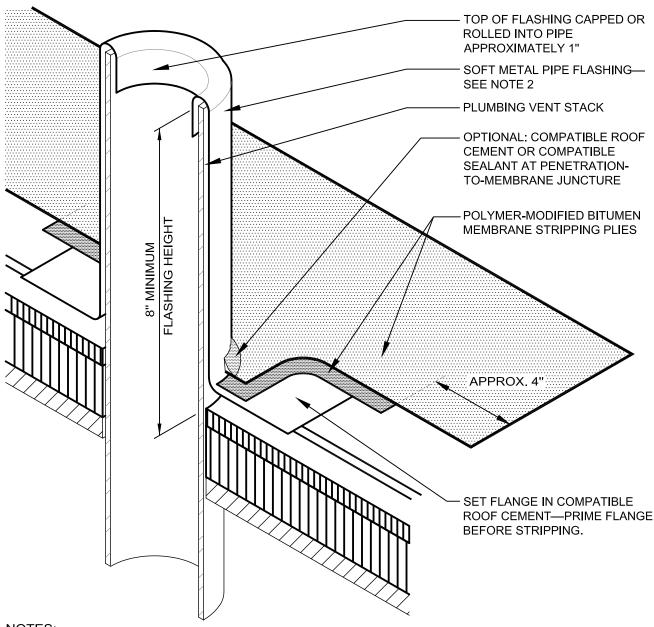
SHEET-METAL STACK VENT [HOT OR COLD] (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)



- . THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2. SOFT METAL PIPE FLASHING:
 - -SHEET LEAD: MINIMUM OF 2 1/2 LBS. PER SQUARE FOOT OR -SHEET COPPER: MINIMUM 16 OZ.
 - PRECAUTIONS SHOULD BE TAKEN NOT TO DAMAGE THE SHEET LEAD WHEN USING HEAT-WELDED APPLICATION.
- 3. IF USING COPPER FLASHING OVER AN IRON OR STEEL PIPE, INSERT A SEPARATOR SHEET (E.G., ASPHALT-SATURATED ROOFING FELT) WRAPPED AROUND PIPE TO SEPARATE THE COPPER FLASHING FROM DIRECT CONTACT WITH PIPE AND REDUCE GALVANIC ACTION.
- 4. VENT STACKS AND OTHER PIPES SHOULD HAVE A MINIMUM OF 12 INCHES OF CLEARANCE ON ALL SIDES FROM WALLS, CURBS AND OTHER PROJECTIONS TO FACILITATE PROPER FLASHING. SEE THE INTRODUCTION TO THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.
- 5. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 6. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



PLUMBING VENT (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)

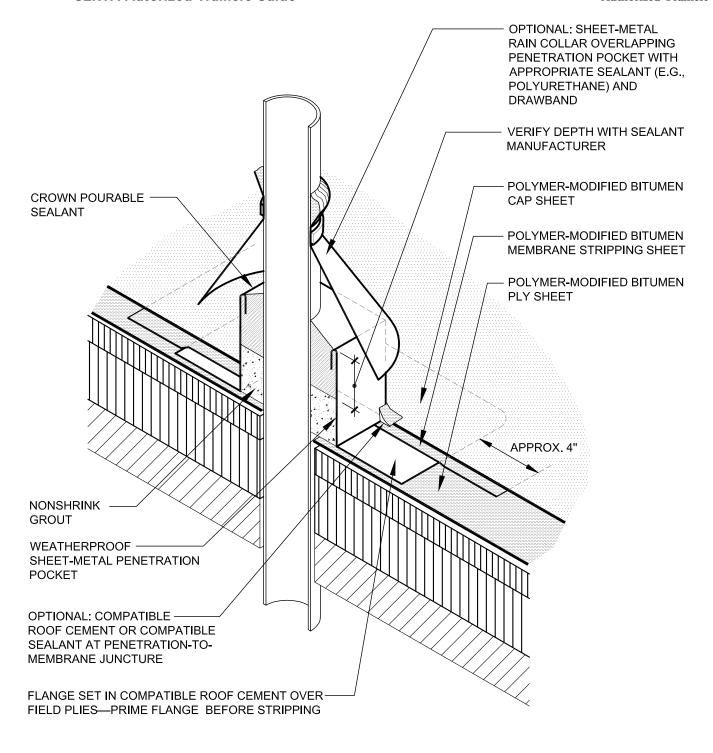


- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
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PLUMBING VENT (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)

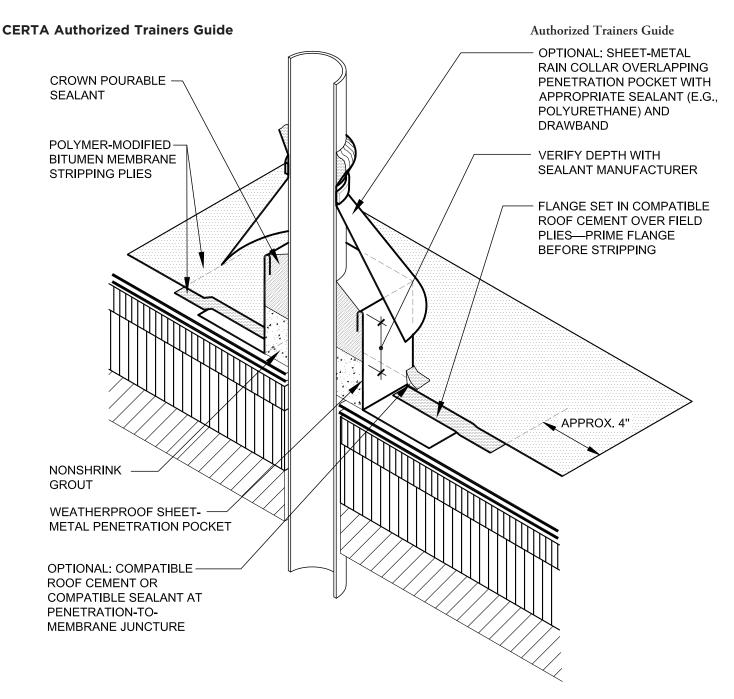
2023 **MB-19A** NOT DRAWN TO SCALE



- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2. PENETRATION POCKETS ARE NOT THE PREFERRED FLASHING METHOD AT THE PENETRATIONS BECAUSE THEY MAY BE A MAINTENANCE PROBLEM. SEE DETAIL MB(L)-20 FOR THE PREFERRED FLASHING METHOD.
- 3. REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR PENETRATION POCKETS.
- 4. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



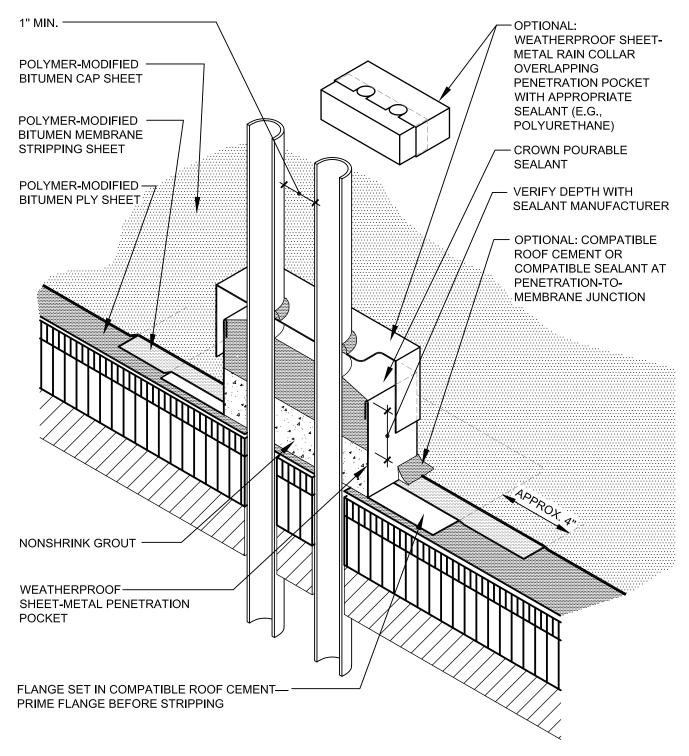
PENETRATION POCKET—SINGLE PENETRATION (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)



- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2. PENETRATION POCKETS ARE NOT THE PREFERRED FLASHING METHOD AT THE PENETRATIONS BECAUSE THEY MAY BE A MAINTENANCE PROBLEM. SEE DETAIL MB(L)-20 FOR THE PREFERRED FLASHING METHOD.
- 3. FOR ROOF SYSTEMS WITH FACTORY-APPLIED GRANULE SURFACING, PROPERLY PREPARE CAP SHEET TO RECEIVE FLASHING.
- 4. REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR PENETRATION POCKETS.
- 5. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



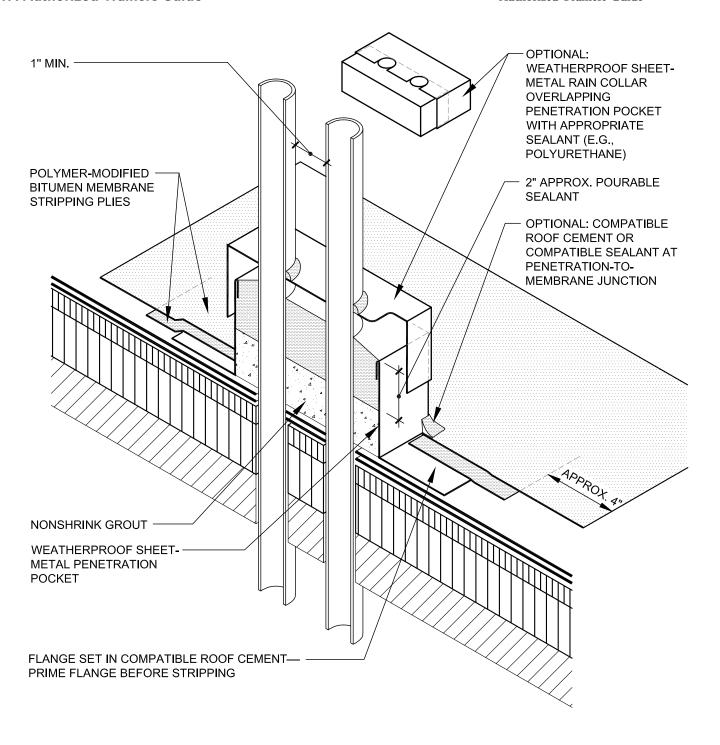
PENETRATION POCKET—SINGLE PENETRATION (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)



- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2. PENETRATION POCKETS ARE NOT THE PREFERRED FLASHING METHOD AT THE PENETRATIONS BECAUSE THEY MAY BE A MAINTENANCE PROBLEM.
- 3. REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR PENETRATION POCKETS.
- 4. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



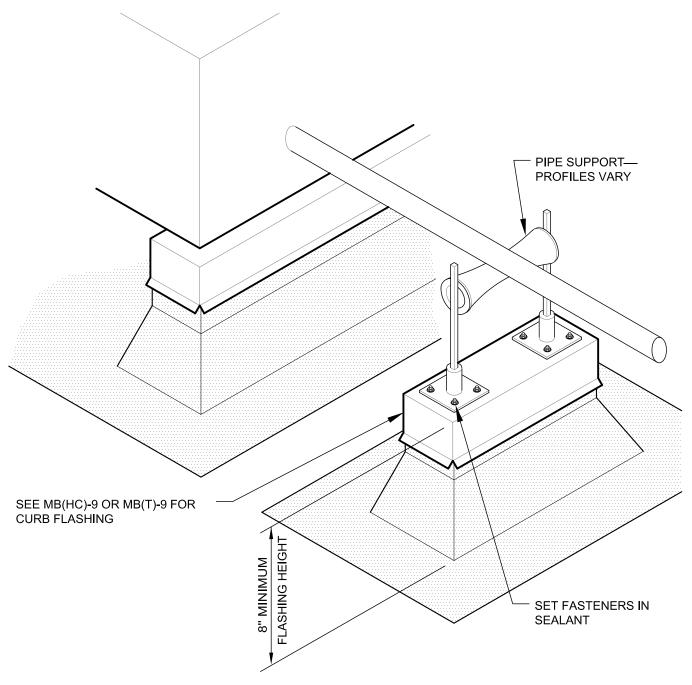
PENETRATION POCKET—DOUBLE PENETRATION (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)



- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2. PENETRATION POCKETS ARE NOT THE PREFERRED FLASHING METHOD AT THE PENETRATIONS BECAUSE THEY MAY BE A MAINTENANCE PROBLEM.
- 3. FOR ROOF SYSTEMS WITH FACTORY-APPLIED GRANULE SURFACING, PROPERLY PREPARE CAP SHEET TO RECEIVE FLASHING.
- 4. REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR PENETRATION POCKETS.
- $5. \quad \text{REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION. } \\$



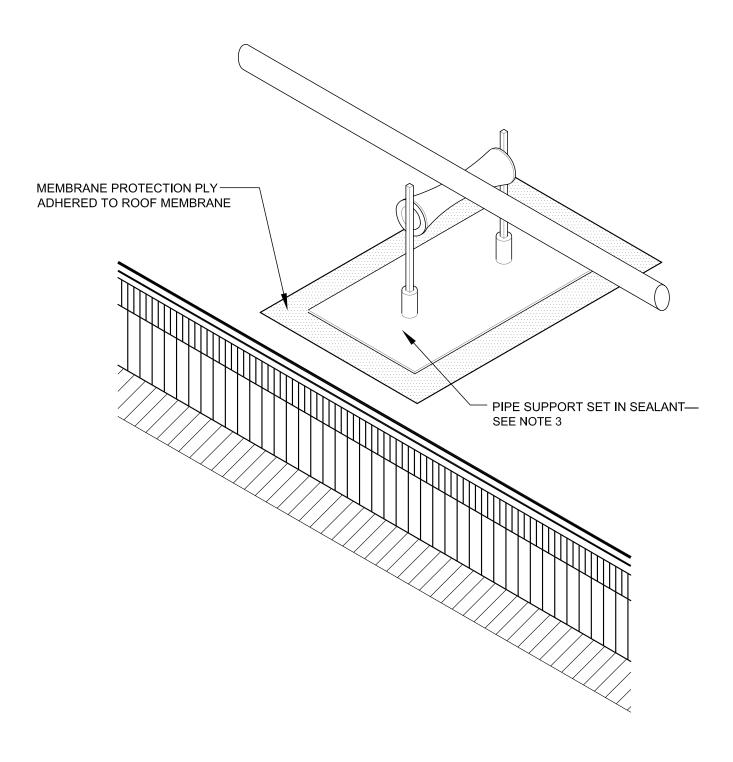
PENETRATION POCKET—DOUBLE PENETRATION (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)



- THIS DETAIL IS DESIGNED TO ELIMINATE ROOF DAMAGE RESULTING FROM EXPANSION AND CONTRACTION OF PIPES. PIPE SUPPORT PROFILES VARY.
- 2. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (50,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 3. REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR SHEET-METAL COVERS.
- 4. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



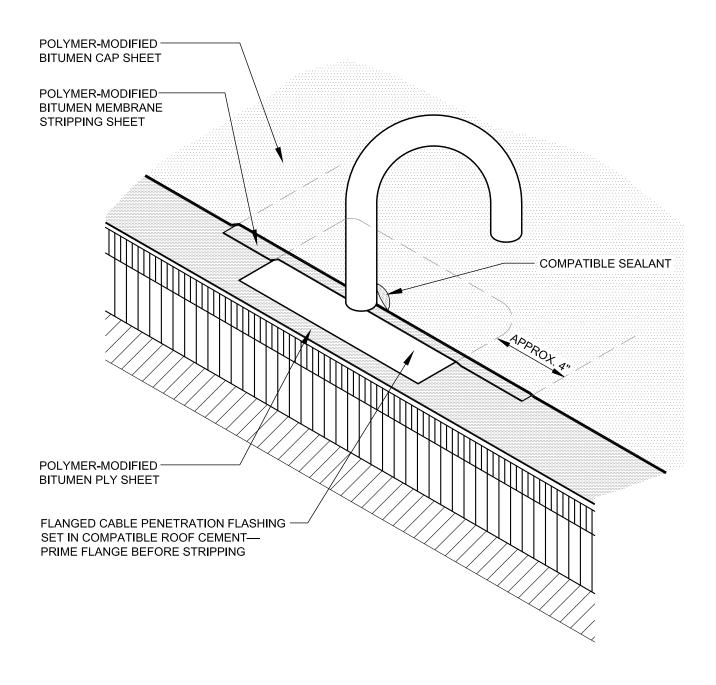
PIPE SUPPORT CURB (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)



- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2. THIS DETAIL IS DESIGNED TO ELIMINATE ROOF DAMAGE RESULTING FROM EXPANSION AND CONTRACTION OF PIPES.
- 3. PIPE SUPPORT PROFILES VARY. REFER TO THE MANUFACTURER FOR LOAD CAPACITY AND RECOMMENDED SPACING OF SUPPORTS.
- ${\tt 4.} \quad {\tt REFER} \ {\tt TO} \ {\tt THE} \ {\tt INTRODUCTION} \ {\tt OF} \ {\tt THE} \ {\tt CONSTRUCTION} \ {\tt DETAILS} \ {\tt CHAPTER} \ {\tt FOR} \ {\tt ADDITIONAL} \ {\tt INFORMATION}.$



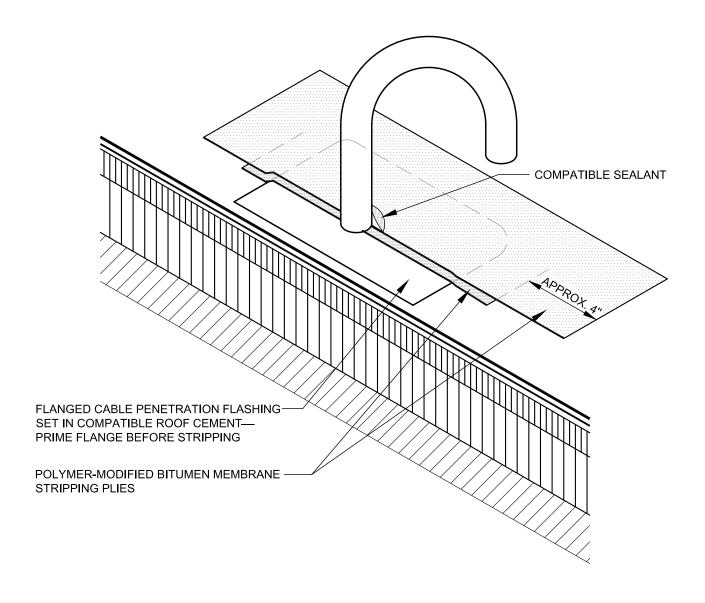
PIPE SUPPORT (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)



- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2. DETAIL DEPICTS THE WEATHERPROOFING PROTECTION AND DOES NOT REPRESENT LIGHTNING PROTECTION DESIGN.
- 3. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



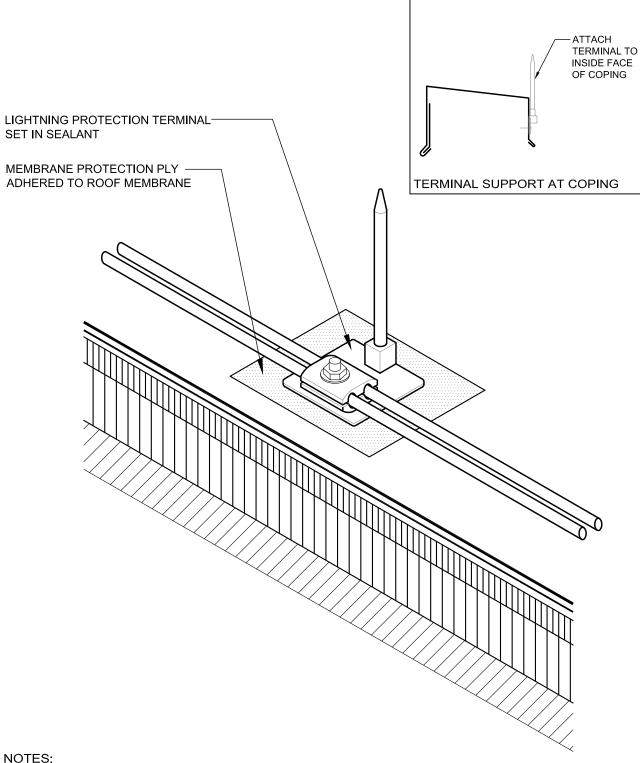
CABLE PENETRATION (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)



- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2. DETAIL DEPICTS THE WEATHERPROOFING PROTECTION AND DOES NOT REPRESENT LIGHTNING PROTECTION DESIGN.
- 3. FOR ROOF SYSTEMS WITH FACTORY-APPLIED GRANULE SURFACING, PROPERLY PREPARE CAP SHEET TO RECEIVE FLASHING.
- 4. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



CABLE PENETRATION (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)

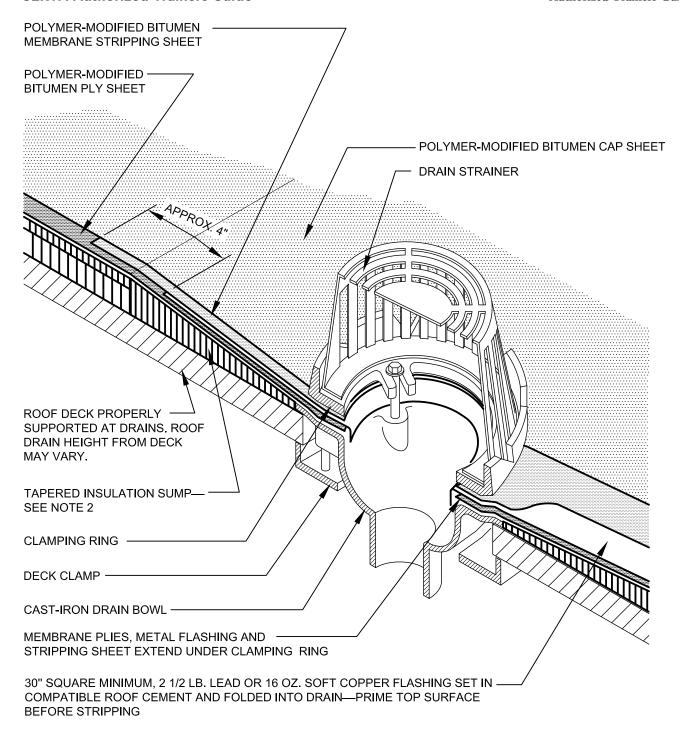


- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- DETAIL DEPICTS THE WEATHERPROOFING PROTECTION AND DOES NOT REPRESENT LIGHTNING PROTECTION DESIGN.
- FOR ROOF SYSTEMS WITH FACTORY-APPLIED GRANULE SURFACING, PROPERLY PREPARE CAP SHEET TO RECEIVE FLASHING.
- REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



LIGHTNING PROTECTION TERMINAL (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)

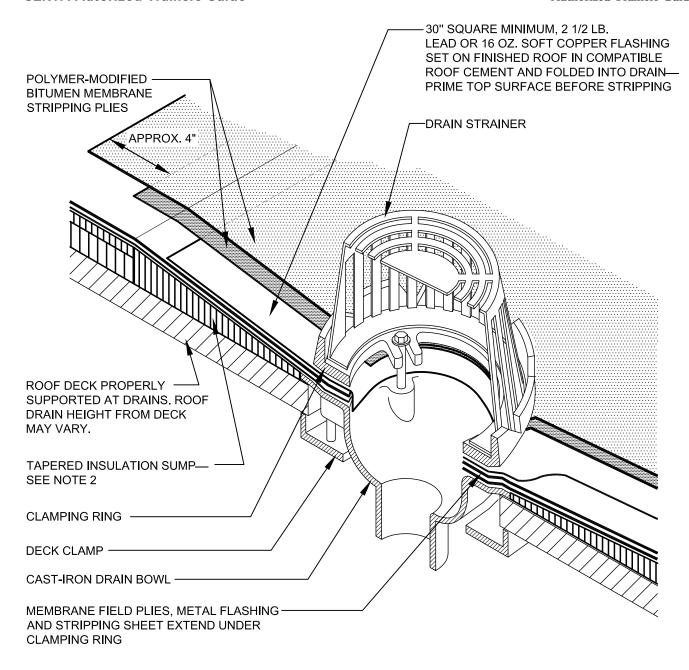
2023 **MB-24** NOT DRAWN TO SCALE



- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2. THE USE OF A METAL DECK SUMP PAN IS NOT RECOMMENDED. HOWEVER, DRAIN RECEIVER/BEARING PLATES ARE APPLICABLE WITH SOME PROJECTS.
- 3. THE DESIGNER SHOULD CONSIDER INSULATING THE DRAIN COMPONENTS BELOW THE DECK TO PREVENT POTENTIAL CONDENSATION.
- 4. MEMBRANE SEAMS SHOULD NOT INTERSECT DRAIN CLAMPING RING.
- 5. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



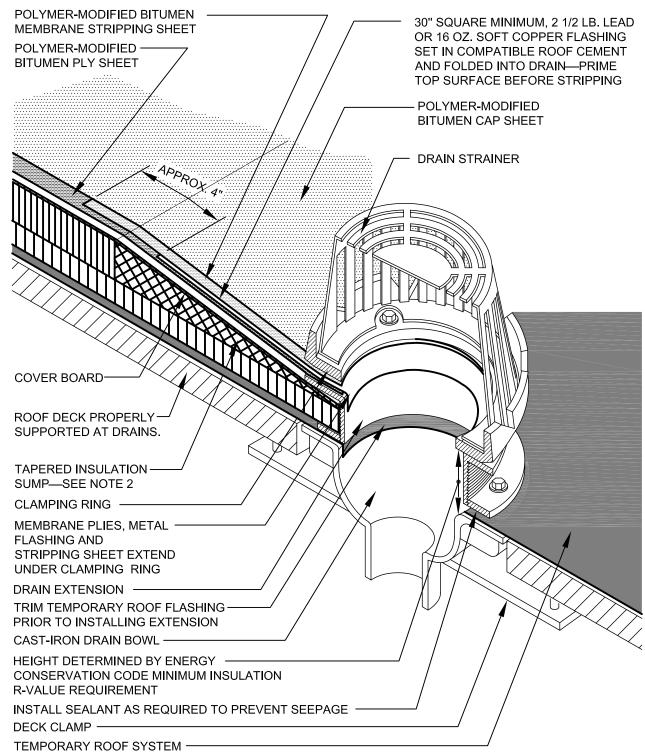
ROOF DRAIN (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)



- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2. THE USE OF A METAL DECK SUMP PAN IS NOT RECOMMENDED. HOWEVER, DRAIN RECEIVER/BEARING PLATES ARE APPLICABLE WITH SOME PROJECTS.
- 3. THE DESIGNER SHOULD CONSIDER INSULATING THE DRAIN COMPONENTS BELOW THE DECK TO PREVENT POTENTIAL CONDENSATION.
- 4. MEMBRANE SEAMS SHOULD NOT INTERSECT DRAIN CLAMPING RING.
- 5. FOR ROOF SYSTEMS WITH FACTORY-APPLIED GRANULE SURFACING, PROPERLY PREPARE CAP SHEET TO RECEIVE FLASHING.
- 6. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



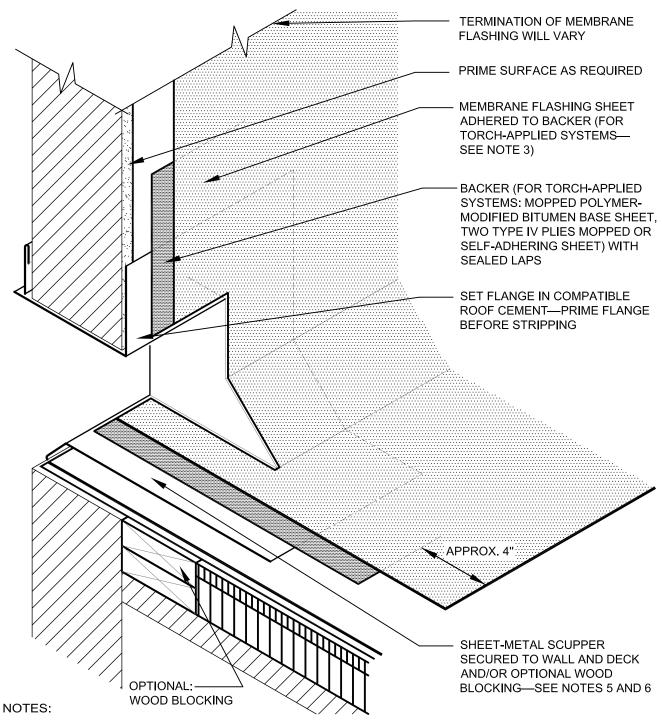
ROOF DRAIN (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)



- THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- THE USE OF A METAL DECK SUMP PAN IS NOT RECOMMENDED. HOWEVER, DRAIN RECEIVER/BEARING PLATES ARE APPLICABLE WITH SOME PROJECTS.
- 3. THE DESIGNER SHOULD CONSIDER INSULATING THE DRAIN COMPONENTS BELOW THE DECK TO PREVENT POTENTIAL CONDENSATION.
- 4. MEMBRANE SEAMS SHOULD NOT INTERSECT DRAIN CLAMPING RING.
- 5. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



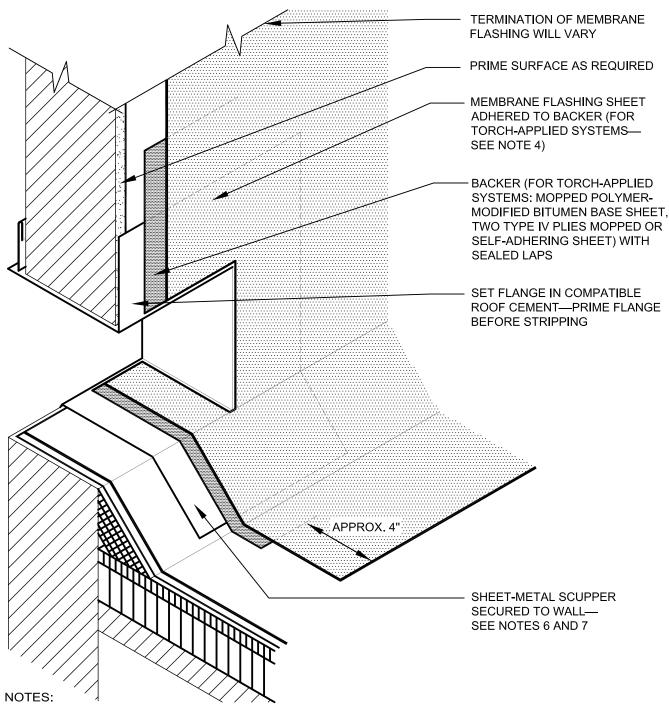
ROOF DRAIN WITH EXTENSION AND TEMPORARY ROOF SYSTEM (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)



- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2. THIS DETAIL DOES NOT ALLOW FOR DIFFERENTIAL MOVEMENT BETWEEN THE DECK AND WALL.
- 3. WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 4. FOR ROOF SYSTEMS WITH FACTORY-APPLIED GRANULE SURFACING, PROPERLY PREPARE CAP SHEET TO RECEIVE FLASHING.
- REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR SCUPPERS.
- 6. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



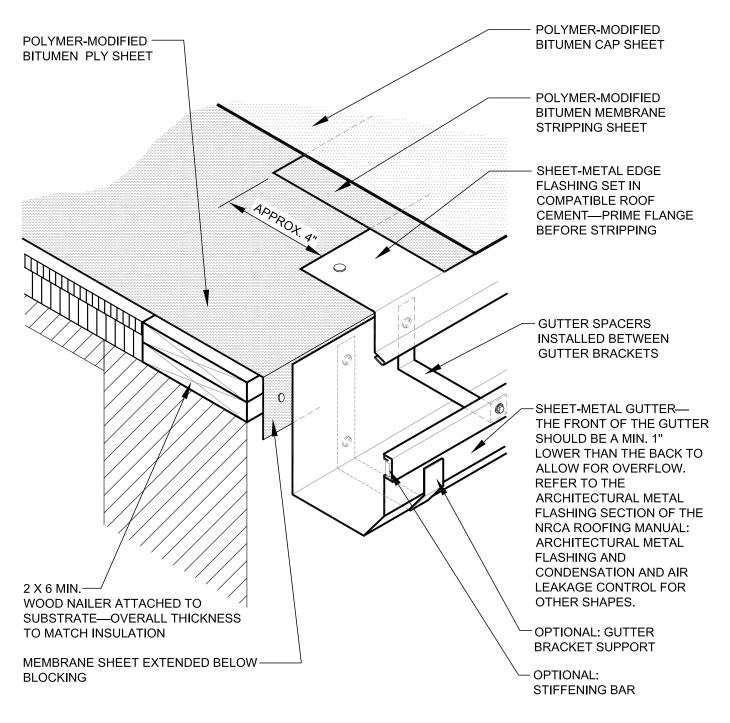
THROUGH-WALL SCUPPER (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)



- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2. THIS DETAIL DOES NOT ALLOW FOR DIFFERENTIAL MOVEMENT BETWEEN THE DECK AND WALL.
- ELEVATION OF SCUPPER MAY VARY.
- WHEN POTENTIAL FIRE HAZARDS CAN BE MITIGATED, NRCA CONSIDERS IT ACCEPTABLE TO INSTALL TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET OVER THE SPECIFIED BACKER FLASHING USING THE DIRECT TORCHING METHOD PROVIDED LOW OUTPUT (105,000 BTU OUTPUT OR LESS) TORCHING EQUIPMENT IS USED. WHEN POTENTIAL FIRE HAZARDS CANNOT BE ADEQUATELY MITIGATED, TORCH-APPLIED POLYMER-MODIFIED BITUMEN SHEET SHALL BE INSTALLED USING INDIRECT TORCHING METHODS, SUCH AS THE TORCH-AND-FLOP APPLICATION METHOD.
- 5. FOR ROOF SYSTEMS WITH FACTORY-APPLIED GRANULE SURFACING, PROPERLY PREPARE CAP SHEET TO RECEIVE FLASHING.
- 6. REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR SCUPPERS.
- 7. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



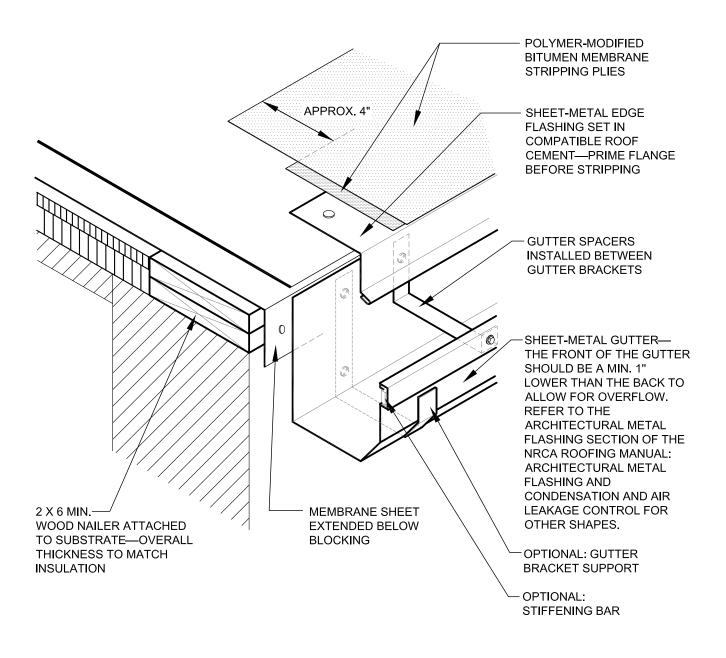
OVERFLOW SCUPPER (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)



- 1. THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2. IN CLIMATES WHERE THE WINTER TEMPERATURE REMAINS BELOW FREEZING FOR EXTENDED PERIODS OF TIME, NRCA SUGGESTS USING INTERIOR DRAINS TO DRAIN THE ROOF.
- 3. GUTTER BRACKETS ARE RECOMMENDED TO BE AT LEAST ONE GAUGE HEAVIER THAN GUTTER STOCK.
- 4. REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR GUTTERS.
- 5. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



GUTTER WITH PERIMETER EDGE METAL (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)



- THIS DETAIL IS APPLICABLE FOR HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS.
- 2. IN CLIMATES WHERE THE WINTER TEMPERATURE REMAINS BELOW FREEZING FOR EXTENDED PERIODS OF TIME, NRCA SUGGESTS USING INTERIOR DRAINS TO DRAIN THE ROOF.
- 3. GUTTER BRACKETS ARE RECOMMENDED TO BE AT LEAST ONE GAUGE HEAVIER THAN GUTTER STOCK.
- 4. FOR ROOF SYSTEMS WITH FACTORY-APPLIED GRANULE SURFACING, PROPERLY PREPARE CAP SHEET TO RECEIVE FLASHING.
- 5. REFER TO THE ARCHITECTURAL METAL FLASHING SECTION OF THE NRCA ROOFING MANUAL: ARCHITECTURAL METAL FLASHING AND CONDENSATION AND AIR LEAKAGE CONTROL FOR DESIGN, JOINERY AND SECUREMENT OPTIONS FOR GUTTERS.
- 6. REFER TO THE INTRODUCTION OF THE CONSTRUCTION DETAILS CHAPTER FOR ADDITIONAL INFORMATION.



GUTTER WITH PERIMETER EDGE METAL (HOT-, COLD- OR TORCH-APPLIED FLASHING SYSTEMS)