WHITE PAPER

Roof Seaming Best Practice Guide

The purpose of this guide is to familiarize personnel with the general knowledge, basic operation, safety, and maintenance procedures followed by standard troubleshooting suggestions for standard roof seaming processes. This is a general guide to be used in conjunction with the material installation guide and the project's erection drawings. The installation contractor is responsible for the proper seaming of the roof in accordance with the erection drawings and with good engineering and construction practices. If questions arise about specific roof seaming equipment and solutions that cannot be found in this guide, contact the OEM (Original Equipment Manufacturer) or equipment supplier. In no case are these guidelines intended to supersede any of the specific recommendations or instructions from the roof seamer manufacturer or roof system supplier.

This is a common style of roof seamer designed to be as small and lightweight as possible for safer usage on a roof.

General Overview

Roof seaming is required whenever a field-seamed “standing seam” metal roof system is installed. Roof seaming is the process where a machine travels across seams or areas where two or more panels are to be joined. Seaming is the process whereby these seams are bent and formed together mechanically.

This process is not required with snap-together seam profiles. Seaming does not guarantee weather-tightness but used in conjunction with roof panel manufacturer-approved details, sealants, and other resources will help achieve this goal.

Roof seaming, as a process, can be compared to roll forming. It is the continuous bending operation through a consecutive set of rolls or rollers each performing only an incremental part of the bend until the desired seam is obtained. Roof seaming through this process is ideal for producing a uniform seam appearance in long lengths or large quantities as compared to flat forming with hand tools in small increments.

The unseamed panels must be installed and nested together properly before seaming can begin.

This seam type is commonly referred to as a 90° seam by the 90° of travel that the material moved from the unseamed profile.

This seam type is commonly referred to as a 180° seam by the additional 90° of travel that the material moved from the 90° profile.

A variety of seamed profiles can be produced, but each profile requires a carefully crafted set of rollers and set up designs. The above seams are common architectural and/or trapezoidal style roof panels. The seam profile is greatly affected by:

- environmental considerations such as geographic location, weather patterns, wind loads, and snow loads
- design requirements by the system OEM, engineers, architects, and inspectors
- desired aesthetic finishes requested by the end-user

This information is decided in the building design and planning stages and should be strictly followed.

In some cases, roof seaming machines are proprietary to a roof panel manufacturer's process, warranty, or production guidelines. The OEM or supplier should always be consulted in choosing the correct roof seamer for a specific project. In any case, testing and certification should always be conducted on the equipment to ensure proper fit and results will be given before seaming any roof system. Roof seamers are specialized and calibrated tools that are designed to work with specific roof systems and panels. It is very important to verify the use of the correct roof seamer specifically designed for a roof system.

Glossary of Terms

A list of terms and nomenclature used within this guide to describe hand crimping and seaming operations:

- **Panel Seam:** Male and female panel seam components that are properly joined together within a roof system.
- **Finished Panel Seam:** A seam that has been completely or partly hand-crimped or mechanically seamed into the appropriate finished seam profile.
- **Finished Seam Profile:** The degree of union between two panel seams. This can be measured by degree, thickness, or various other specifications.
- **90° Seam:** A generic reference to the 90° of motion that material travels to form the finished seam profile. There are many trade names that refer to this type of seam including Single Lock, First Stage, or TripleLok™. Verify the product nomenclature to become familiar with the terms used for a specific project.
- **180° Seam:** A generic reference to the additional 90° of motion that material travels from the 90° seam to form the finished seam profile. There are many trade names that refer to this type of seam including Double Lock, Second Stage, or QuadLok™. Verify the product nomenclature to become familiar with the terms used for a specific project.
- **Flat Forming:** Similar to press brake forming. Simply bending the metal sheeting utilizing a "pinching" action and forms the stock in a non-continuous process.
- **Roll Forming:** A continuous metal forming process taking sheet, strip, or coil stock and bending it between successive pairs of rolls that increasingly bends it until the desired shape is completed adding both strength and rigidity to lightweight materials.

Training

Before using a roof seamer, all personnel should be thoroughly instructed on the operation, maintenance and safety precautions of the machine. Adequate training greatly enhances the safety of all operations and the resulting seams.

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New operators should be initially assigned to work with an experienced and qualified operator or under the direct supervision of a knowledgeable person(s) until they have gained sufficient familiarity to work independently. Operators and maintenance personnel must observe all safety signs and procedures. All safety signs and procedures are for the operator's protection and must be read, understood, and taken seriously.

Whenever there is a problem or the potential for a problem, **STOP THE EQUIPMENT FIRST**, then solve the problem using only safe procedures. This may require the operator or service personnel to stop and ask for help from someone who knows what to do. It could also require referral to the manual or calling the OEM or supplier for help. This guide should be kept in an easily accessible location.

Operating Safety Guidelines

- **Capacity:** Operate the roof seaming machine within its designed/rated capacity for material, pitch, panel finish, etc. Do not overload.
- **Shutdown:** Turn off power and disconnect from the power source prior to performing any maintenance, adjustments, or cleaning. Follow "Lock Out/Tag Out" procedures additionally defined by the employer and/or local electrical safety codes.
- **On/Off Procedures:** Know the location of all operator controls used to start this machine to avoid accidentally turning on/off. When leaving the work area unattended, turn off all equipment controls and disconnect the power source.
- **Attire:** Do not wear clothing or jewelry that could cause a hand, arm, or any part of the body to be pulled into the rollers or caught by the operating seaming machine.
- **Modification:** Never modify, alter, adjust, or change the design of the roof seaming machine without first contacting the OEM. If the machine does not meet the project requirements, stop immediately and contact the OEM.
- **Lifting:** Roof seaming machines are usually too heavy to carry up a ladder safely; always hoist the machine onto the roof utilizing proper lifting equipment.
- **Elevated Fall/Drop Safety:**
    - Always tie off all tools and roof seaming machines while not on the ground. Tie off at proper and designated locations on the seaming machine using ropes or cables with the appropriate drop capacity for the tool being used and attached to appropriate anchor points. All OSHA, company and local guidelines should be followed to prevent accidents or near-misses.
    - When not locked to the seam, the seaming machine can freely roll on its wheels. Always secure the machine to prevent it from rolling or sliding off the roof.
    - When running the machine in the down-slope direction, the machine will have greater inertia and coasting distance.
    - Never ride on the seaming machine or allow it to support the operator's body weight in any way.

Before Seaming Operations

Before any roof seaming operations begin, it is necessary to make sure that the roof system is ready for seaming. Ensure proper installation of roof panels according to the panel manufacturer's installation instructions. Poor installation practices can result in faulty seaming. Such faulty seaming can result in difficulty

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and objectionable seam appearance. In severe cases, reduction in roof performance, or the need to replace the roof entirely may result.

The work area must be free of debris, dirt, sand, and other contaminants that could affect the performance of the seaming machine. Contaminants can be picked up by the forming rollers and transferred to the panel seam leading to the potential for panel finish damage. Check for safety concerns including extension cords, safety tethers, and other items that could cause a trip hazard.

NOTE: The roof panels must be correctly seamed before the roof system can meet the design wind load and weather capability. This means that an un-seamed or improperly seamed roof is subject to wind load failure and/or weather resistance failure. It is recommended to "seam as you go". This means that the roof panels should be seamed as they are installed. This minimizes the risk of modulation issues and other common installation problems as well as wind damage during construction.

Depending on how the roof panels were installed, the seaming machine may run from the ridge to the eave or from the eave to the ridge. Become familiar with the direction of the seaming machine as indicated on the labeling or in the equipment manual. Use this information, along with these installation practices, to understand how the machine will run before getting on the roof to work.

Roof seamers are calibrated specifically for a given type of roof panel. Ensure that the roof seamer to be used is matched with the material on the project. Material gauge, profile, seam requirements, pitch, radius, and other factors play a key part in how a roof seamer is constructed.

Like the roof seamer, always use hand crimpers designed to work with both the roof seamer and the roof panel being installed. It is important to understand hand crimping and how it relates to the specific roof system before attempting to use the tools. Hand crimping a roof panel accomplishes multiple things including helping to hold the panels in place after the installation, but before seaming. Hand crimping is also used as a starting point for the roof seamer along with finishing a seam near the end of the panel or close to a roof penetration that cannot be completed with the seaming machine. These instructions must be read and understood in their entirety before any seaming operations occur.

Seaming

Seaming will begin with engaging the forming dies onto the panel seam. This is commonly accomplished by first flat forming the seam into the desired shape with hand crimpers. This will allow for the progressive die rollers to be engaged at different locations on the crimp that align with their intended purpose. After proper hand crimping, engage the seaming machine tooling.

After engaging the forming tooling and applying the appropriate power supply, operate the seaming machine for approximately twelve inches and turn the power off. Inspect the seam created and verify that this is an acceptable result. If there are questions about the seam appearance or problems operating the machine, stop and contact the OEM or metal panel supplier for further information and help with troubleshooting the issue. In most cases, a problem will not correct itself over time. If everything appears acceptable, continue seaming.

NOTE: Environmental considerations should be taken in extreme temperatures or inclement weather. Consult the OEM for performance guidelines on specific equipment.

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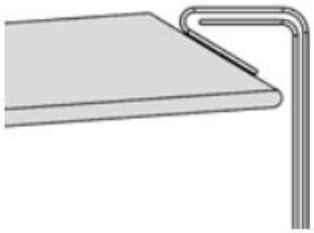
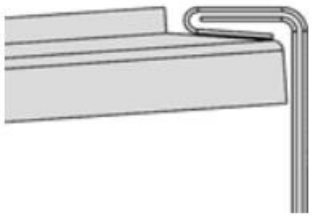
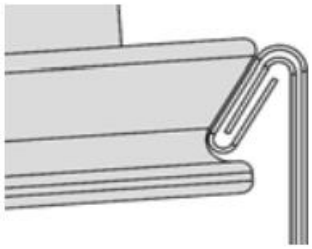
Progressive die rollers positioned over a flat formed section of a roof panel. The panel shows how the rollers bend the metal in each stage to form the desired finished seam.



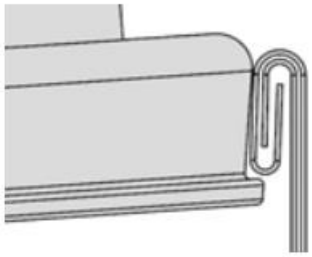
Step 1: The first roller will usually move the downward leg of the female side of the roof panel approximately 45°.



Step 2: The second roller will usually move the downward leg of the roof panel approximately 90°. This will complete the 90º seam in some applications. If a 90° seam is desired, this will typically be complete over a set of 3 rollers for a slower progression.



Step 3: The third roller will usually move the roof panel approximately 135°. This will begin the transition between the 90° seam and the 180° seam.



Step 4: The fourth roller will usually complete the finished panel seam to the full 180°. This finished seam profile can sometimes be completed with more or less than 4 rollers. Some roof seamer designs will vary in appearance and tooling. Always ensure that the correct equipment is being used for the specific material on the project

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After Seaming Operations

Visually inspect the finished seam for a uniform appearance. If the panel manufacturer provided tolerances, measure the finished seam profile to ensure dimensions are considered acceptable.

Maintenance

The installation contractor is responsible for the inspection and proper maintenance of the roof seaming machine to ensure that equipment and parts are in safe operating condition. Only qualified personnel should work on the equipment or its circuitry.

The seaming machine is a precision fabricated, portable roll forming machine. This relatively lightweight machine does the job of forming finished seams often under rugged field conditions. Although designed for tough industrial use, the seaming machine requires proper maintenance to assure proper seaming and efficient, trouble-free operation. Failure to properly maintain the seaming machine as instructed below can result in faulty or damaged seams and costly breakdowns of the seaming machine.

At the end of use or when the seaming tools are not in use, the machine must be stored in a proper container, in a safe and dry area. The seaming tools must be cleaned and dried before storing. Temperature controlled environments are preferred for the longevity of the lubricants and wear of internal moving components.

Absolutely no repairs should be performed on the equipment without first contacting the OEM. Only with OEM approval or detailed instructions provided with the equipment can personnel perform any repairs or adjustments.

Most common seaming machines are powered by electricity; some models may be powered by gasoline or by a hand crank. The following recommendations are for electrical motors that power seaming machines: The seaming machine motor will usually require a minimum electrical power supply of 20 amps @ 120 Volts @ 60 Hz AC. The electrical service and cords to the seaming machine must be of sufficient capacity to provide the full 20 amp @ 120 Volts *at the seaming machine*. If other tools or equipment are being used on the same service, the service and cord capacity must be increased accordingly. Low voltage due to insufficient cord size or excessive cord length will cause overheating and burnout of the seaming machine motor. The following chart shows recommended extension cord sizes:

Distance (Ft)	0 – 50	50 – 100
Wire Gauge	12	10

- Power cords must have the correct plug for a safe and secure electrical connection to the seaming machine.
- Power cords must be properly grounded, and the service must have a ground fault circuit breaker.
- The electrical cord must be of sufficient length to cover the full area to be seamed without stress on the cord or its connections.
- The cord path must be clear of snagging on panel edges or entanglement into the seaming machine rollers.
- The cord must be seated completely into the machine's power port to prevent a faulty connection and potential damage to the motor.

While using the seaming machine outside of the United States or Canada, consult the OEM or supplier for conversion options.

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COOLING VENTS: To prevent electric motor overheating, the motor has vents and an internal fan to provide cooling airflow over the internal motor parts. Frequently check that these vents are clean and clear of debris. While the machine is running, never cover the machine or place it in a position where the cooling airflow to the vents will be restricted.

FORMING ROLLERS: The forming rollers require the following regular maintenance:

- Ensure that the forming rollers are free of dirt, grease, sealant/mastic, etc. These may be cleaned with an abrasive cloth and mineral spirits or penetrating oil. Sandpaper should never be used as this could alter the critical dimensions of the roller.
- Ensure that forming rollers are tight on the shafts. Check and tighten roller retainer screws as necessary.

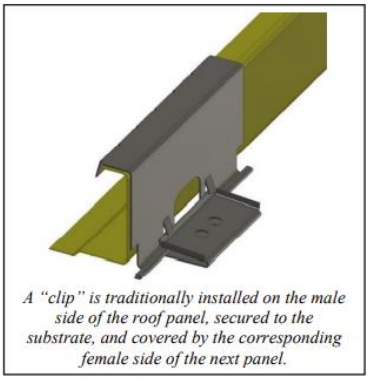
On painted roofs, especially during very hot or abrasive conditions, spraying or misting the seams with water, or a light lubricant, ahead of the seaming machine may significantly reduce burnishing and marking of the seam surface. The contractor should verify that the lubricant will have no negative effects on the painted finish.

On very dry galvanized roofs, spraying or misting the seams with water, or a light evaporative lubricant, ahead of the seaming machine may significantly reduce seaming friction and galvanized flake build-up on the forming rollers. The contractor should verify that the use of any evaporating lubricants will have no negative effect on the galvanized surface.

NOTE: Light evaporative lubricants can cause a fall/slip hazard. Use extreme caution.

Clips and Fasteners

Mechanically seamed standing seam roof systems are often installed with methods other than a through fastened attachment of the roof panels to the building frame. This is accomplished with formed pieces of metal of varying thickness, design, and size known as "clips" being attached by fasteners to the substrate and concealed within the seam of the roof panel. Clip designs for standing seam roof systems are specific to the respective metal panel's dimensional characteristics and seam design.



A "clip" is traditionally installed on the male side of the roof panel, secured to the substrate, and covered by the corresponding female side of the next panel.

Two common clip styles are referred to as "fixed" and "floating". Fixed clips do exactly as the name implies; once attached to the substrate, they do not move. Floating clips move slightly to allow for the expansion and contraction of the panels and resistance to design loads. The clips are attached to the frame or substrate of the building by fasteners and, in most cases, are placed on or aligned along the male side of the roof panel. To choose the correct fastener, consult the Metal Construction Association's *Proper Tools for Fastening Metal Panels and Compatibility of Fasteners with Profiled Metal Roof and Wall Panels* Technical Bulletins as well as the manufacturer's guidelines.

Caution and experience are necessary for proper placement and alignment of clips during installation. The designer, architect, panel manufacturer, or design engineer must be consulted to ensure the utilization of the correct clip/roof panel combination. In evaluating panel and clip designs, the building owner's performance and

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aesthetic requirements must be considered. Clips that are inappropriately mated with the panel, due to materials or design, can cause an objectionable seam appearance.

Seam Sealants

Sealants help provide an additional layer of protection within the seam against external elements. Some seam types do not require sealants to be added while others require sealants to be added in the field or added in the factory during manufacturing. Regardless, sealants can play a vital role in the life of the roof and its performance. Sealants can come in the form of tape or in a liquid state applied from a tube. In either case, confirm with the supplier that the sealant is properly intended for metal roofing.

- **Sealant Tape:** Several sizes of sealant tapes are available, commonly having butyl rubber content. It is important to select the correct types of tape to dimensionally match the seam involved. Depending on installation recommendations, multiple layers may be applied at clip locations or end lap conditions. Ensure that the tape is non-curing and non-skinning with a high percentage of solids. This type of sealant should be pliable with a high degree of tack and elongation.
- **Tube Sealant:** Many variations exist for this style of sealant. It is important to adhere to specifications for the size of the bead applied with this sealant. Using more than recommended can create a hydraulic effect that will cause the finished seam to appear wavy or "blow out" at clip locations

Always keep sealants in their original packaging and away from the elements until the time of use. Before application of either type of sealant, panels must be clean and clear of debris, moisture, and manufacturing compounds. Foreign contaminants can cause loss of adhesion, microbial growth, and sealant degradation. Too much sealant can cause an objectionable seam appearance and in extreme cases, work against the purpose of the seam and can cause leakage. Note that sealants cannot fix poor panel installation. Diligence in following specifications and tolerances of panel seaming and installation must be followed for sealants to work properly.

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- Monitoring of industry issues, such as codes and standards
- Research to develop improved metal construction products
- Promotional and marketing support for the metal construction industry
- Publications to promote use of metal wall and roof products in construction

For more information, please visit the MCA Web site at www.metalconstruction.org

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