

nVent ERICO Cadweld AND nVent ERICO Cadweld PLUS CONNECTIONS TO PROPULSION RAIL - JOINT BOND

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**I. HOW TO READ THESE INSTRUCTIONS/
WHAT THE SYMBOLS MEAN**

The purpose of safety symbols is to attract your attention to possible dangers. The safety symbols, and the explanations with them, deserve your careful attention and understanding. The safety warnings do not by themselves eliminate any danger. The instructions and warnings are not substitutes for proper accident prevention measures.

SAFETY ALERT SYMBOL: Indicates warning or caution. It may be used in conjunction with other symbols or pictographs.

WARNING: Failure to obey a safety warning may result in property damage, serious personal injury or death, and the serious personal injury or death of others. Always follow the safety precautions to reduce these risks.

CAUTION: Failure to obey a safety caution may result in property damage, personal injury, and injury to others. Always follow the safety precautions to reduce the risk of fire, other property damage and personal injury.

NOTE: Advises you of information or instructions vital to the operation or maintenance of the equipment.

In the following instructions, cautions and warnings, there are two types of consequences for failure to heed:

- A. IMMEDIATE, that may result in personal injury or a failed operation that may result in a less than optimum bond and that will not give the physical and electrical performance expected.
- B. EVENTUAL, that may result in a later premature rail break, causing a serious derailment accident with personal injuries or death, and loss of property.


II. GENERAL RULES FOR SAFETY IN THE APPLICATION OF EXOTHERMIC HEAD BONDS TO RAIL


WARNING: Do not attempt to make an exothermic bond until you have thoroughly read and understand the instructions that accompany all of the various components of the system and have been properly trained in the use of this product. Use only the system components designed to be used together from a single manufacturer. Failure to comply may result in unsatisfactory bonding as well as accidents involving fire, personal injury, and rail damage that may lead to property damage, injury or death.


WARNING: Exothermic connections must not be made to special alloy track components, such as those containing high manganese or chromium, without the prior approval of a qualified expert knowledgeable in rail applications. When determining whether to approve an exothermic weld to a special alloy track connection, the qualified expert will want to consider the following: the chemistry and microstructure of the component material, compatibility with copper weld alloy,

heat input, cooling rate and location of the connection prior to making an exothermic connection. Failure to comply may result in rail break leading to property damage, injury or death to others.

WARNING: Only nVent ERICO approved grinding equipment, welding equipment, welding material, and cable size designed for the specific application must be used. All items used must be designed and supplied by the same manufacturer. All items must be in good condition and not worn, altered or damaged. Failure to do so may result in an unsafe application with the risk of personal injury and/or a less than optimum bond.

WARNING:  The area where the bond is to be applied must be sheltered sufficiently if the weather is inclement. This is to keep the rail surface, all equipment, and materials dry until the weld is completed. Failure to do so may result in an unsafe application with the risk of personal injury and a less than optimum bond.

CAUTION:  The work area must be well ventilated. Workers should avoid breathing the smoke of the exothermic reaction by positioning themselves upwind of the mold before igniting the welding material. After ignition, it is advisable to step back from the mold. Failure to observe this instruction may result in lung irritation.

WARNING:  The worker(s) performing the welding must be properly dressed and equipped. Examples include cotton or woolen garments (most synthetic fabrics melt rather than char when exposed to flame, causing severe burns), safety footwear with non-slip soles, head protection, leather gloves, eye goggles and other clothing and equipment recommended or required by the person's employer, industry practice, or applicable laws and regulations. **See Figure 1.** The worker(s) must not be under the influence of any alcohol, drugs or other chemicals that would impair their judgment or performance of the job. Failure to observe this may result in serious personal injury.

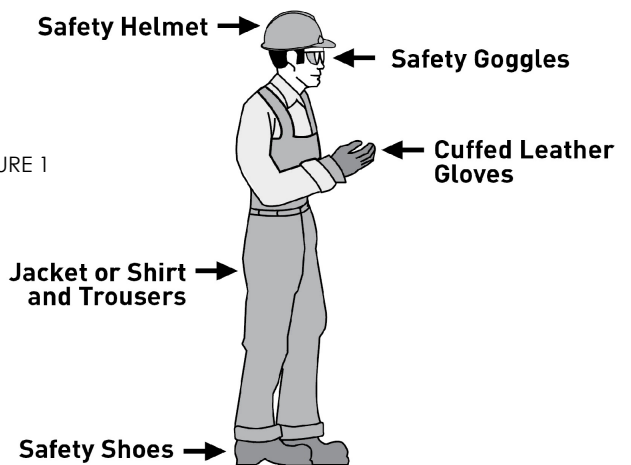




FIGURE 1

CAUTION:  The worker(s) must be certain that they can achieve good footing in the area where the weld will be done. They should be able to step away from the weld reaction, to be upwind of it. Failure to observe this may result in personal injury.

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WARNING:  Carefully following the instructions for **exothermic bonding is very important to achieving a quality reliable bond.** Failure to do so may cause hidden potential problems, the least of which is a poor electrical connection, and the most serious of which is an eventual broken rail leading to property damage, injury or death to the installer and others.



CAUTION:  **The bond terminals must have a bright surface.** Failure to comply with this may result in a less than optimal weld. See Figure 4.




FIGURE 4


III. PREPARATION

WARNING:  **Protect against potential fire hazards local to the bonding area and remove all flammable materials from the work area. Notify in advance other workers in the immediate area that a welding procedure is about to be done.** Failure to do this increases the risk of fire with the possibility of property damage, personal injury and death.

3. Lightly grind the rail surface using an nVent ERICO approved grinding wheel that is self-cleaning or a nVent ERICO Cadweld brand Rail Head and Web Cleaner (Part SBB394C). Grinding wheels with resin binders may leave a surface film that may contaminate the surface, interfering with the achievement of an optimum bond and causing weld porosity.

NOTE: In case of a fire involving large quantities of exothermic welding material, CO₂ or large quantities of water applied from a distance are required to reduce the spread of the fire.

WARNING:  **The area of the rail web to be bonded must be lightly ground to a bright finish with no visible scratch marks or gouges (normal uniform finishing marks are acceptable).** Failure to observe this may result in visible scratches or gouges due to overly aggressive grinding that are potential crack initiators and that may lead to rail breaks causing derailment accidents with property damage, injury and death to others. See Figure 5.

WARNING:  **The location of the bond is very important!** The intent of a rail head bond is to electrically join two rail sections. Rail head bonds must be done only within the confines of the joint/splice bar as near to the bar center as practical. Failure to observe this may result in a rail break leading to property damage, injury or death to others. See Figure 2.

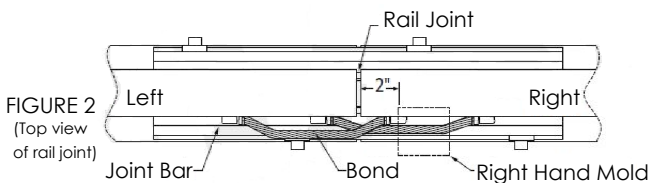


FIGURE 2
(Top view of rail joint)

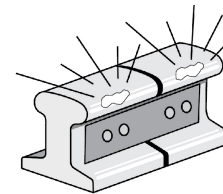



FIGURE 5

CAUTION:  **Grinding must not be done more than 4 hours prior to bonding.** If the time lapse is longer, sufficient contaminating rust may re-form requiring additional grinding. Failure to observe this may result in a less than optimum bond.

1. Clean the rail surface and bond terminals. Scrape off excess dirt and grease, and wipe away any remaining residue using a clean rag saturated with a railroad approved solvent. See Figure 3. The rail must be dry prior to welding!

4. Dry the mold and rail by heating them to about 250°F (120°C) with a small propane torch.

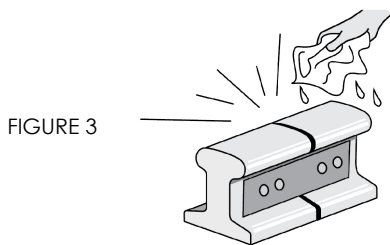



FIGURE 3

WARNING:  **The rail, bond terminal, and mold must all be heated above 250°F (120°C) to drive out moisture.** Failure to observe this may result in weld spatter with the potential for serious burn injury, and an unsatisfactory connection with excessive porosity. See Figure 6.

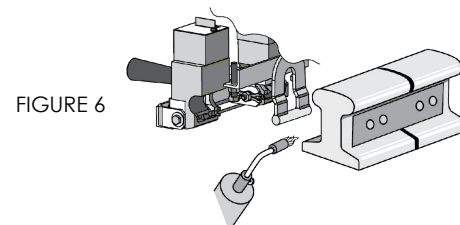




FIGURE 6

WARNING:  **The area of the rail where the head bond will be applied and the bond terminals must be clean and dry.** Failure to comply can cause poor bonding, excessive weld porosity, and/or spewing molten welding material with the potential for serious burns to the worker.

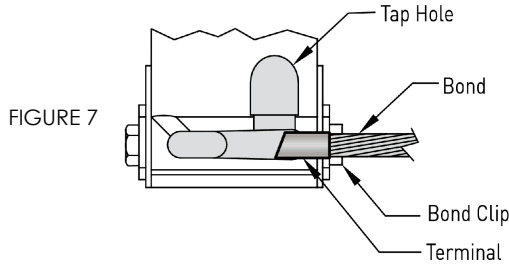
WARNING:  **Rebonding over the application of an earlier bond is only permissible in areas of minimal stress such as the head of the rail within the confines of the joint/splice bar!** Remove the original bond by grinding down to a smooth layer of parent rail steel. The new bond can then be made in the same location as the previous bond. Failure to observe this may result in a rail break leading to property damage, injury or death to others.

2. Use abrasive cloth or wire brush on the bond terminals if needed to remove surface oxidation.

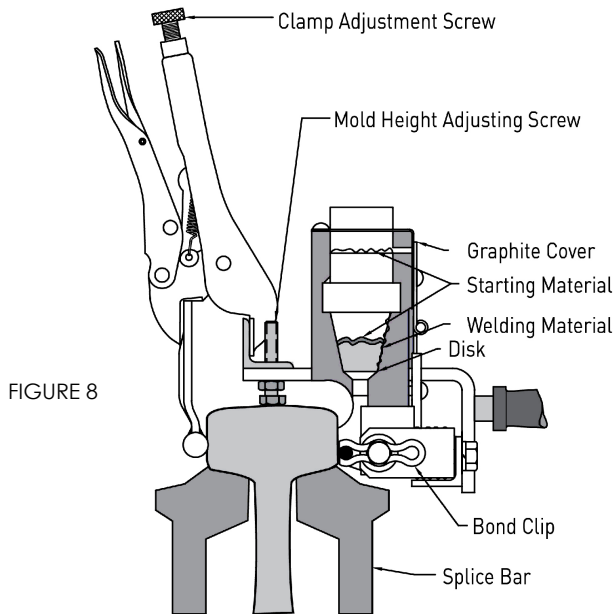
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IV. WELDING PROCEDURE FOR nVent ERICO Cadweld (Blue Tube with Yellow Cap)

- Place bond in welder with flat surface against rail head and end of terminal against bond clip. This correctly positions bond in weld cavity. Be sure the bond clip is in good condition and properly positions terminal under center of tap hole as shown. **See Figure 7.**

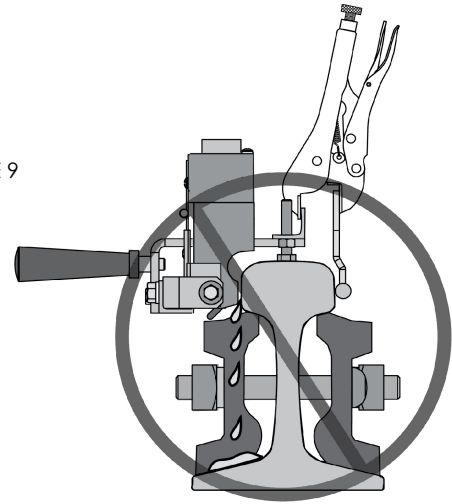


- Position the welder with attached molds on the rail head. The bottom edge of the mold should be aligned with the lower edge of the rail head. Use the mold height adjusting screws to properly align the mold. **See Figure 8.**
- Close clamp to lock welder on rail. Clamp is adjustable for rail sizes. Check that mold face fits against rail and bond terminal is held against rail by clevis. **See Figure 8.**



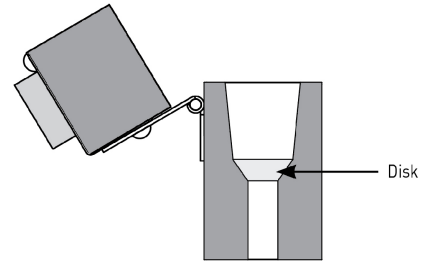
to avoid spillage of the molten metal. Failure to observe this warning may result in molten metal leakage onto the rail or surrounding areas with the immediate risk of personal injury, and potentially serious structural damage to the rail.

FIGURE 9



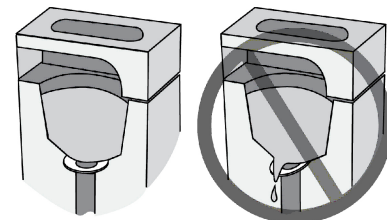
- Insert one steel disk, dished (concave) side up, in the crucible to cover the taphole. **See Figure 10.**

FIGURE 10



CAUTION: The steel disk must be correctly installed into the mold crucible. Failure to properly position it may result in premature leakage into the mold area, resulting in an unacceptable weld. **See Figure 11.**

FIGURE 11



- Dump the contents of the welding material container into the crucible, being careful not to upset the disk.

WARNING: Correctly positioning the mold against the rail is critical for safety and success in making a connection. There must be no clearance between the mold that contains the weld cavity and the rail surface; if a clearance is present or mold is worn, the mold should be discarded and a new one used. **See Figure 9.** (Molds can generally be used for up to 50 welds) The exothermic reaction reaches a temperature in excess of 4000°F, therefore great care must be exercised

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⚠ CAUTION: **Install only the specified welding material in the mold crucible.** Use only the welding material size that is specified on the mold. nVent ERICO brand of welding material (F80) is formulated specifically for use with rail steels; it is packaged in a blue tube with a yellow cap. Dump all of the welding material into the crucible, then carefully tap the tube on a hard surface to loosen the starting material from the bottom of the tube and distribute half on top of the welding material, close the mold cover, and pour the remainder in the opening of the mold cover. **See Figure 12.** Failure to comply may result in difficulty getting the reaction started and/or an unacceptable weld.

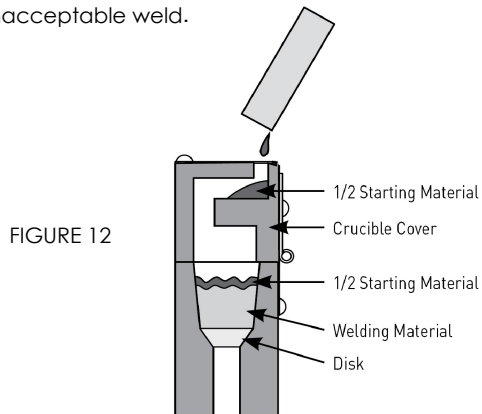


FIGURE 12

⚠ CAUTION: **Avoid direct eye contact with the “flash” of light from the ignition of the starting material.**

- Position yourself upwind of the molds, place the tip of the flint ignitor at the cover opening and ignite. Remove the igniter quickly to prevent fouling. If igniting two molds in sequence, ignite the downwind mold first.

⚠ CAUTION: **Allow 15 seconds for mold cooling after the reaction.**

This will permit the molten metal to solidify. Then carefully disengage the welder device and pull the mold straight back from the rail. Failure to observe this may result in mold damage and its premature scrapping. Molds can generally be used for up to 50 welds.

- Carefully open the mold cover and break up the slag in the crucible using the blade of the mold cleaning tool. Dump the slag from the crucible and remove slag from the tap hole using the curved end of the mold cleaner. Dispose of the slag according to local regulations.
- Unlock clamp and remove welder by pulling the mold straight back from the rail. Failure to observe this may result in mold damage and its premature scrapping. Molds can generally be re-used up to 50 times.
- Dump the slag from the crucible and remove the slag from the taphole using the curved end of the mold cleaner. Dump slag in the ballast, not onto the ties.
- Check the molds for breakage or residual slag before proceeding with next weld.

Changing Molds (See Figure 13.)

- Remove mold back frame Screw “A”.
- Pull out worn mold.
- Insert new mold, replace Screw “A”. Check bolt “B” to be sure it is not too tight. Mold must be free to move within frame against pressure spring.

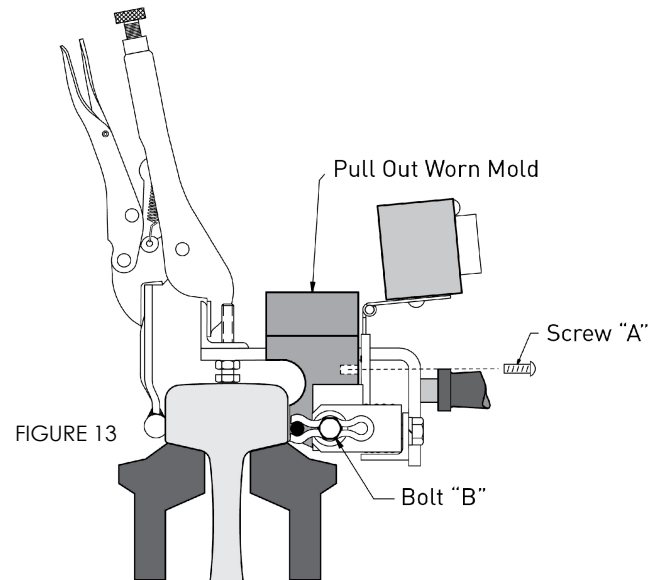


FIGURE 13

V. DOUBLE BONDING PROCEDURE

- Place first bond in welder and locate edge of right hand old approximately 2" from right edge of joint.

NOTE: Placement of first bond as low as possible on rail head will facilitate positioning of second bond. **See Figure 2.**

- Follow Section IV WELDING PROCEDURE for adjusting, clamping and welding.
- Upon completion of welding first bond, tap cable, at center of bond, down with hammer against splice bar for sufficient clearance for welding second bond.
- With second bond installed in welder, center left hand mold between first bond connections and clamp welder to rail. Check that mold face fits tight against rail, as low as possible.
- Follow Section IV WELDING PROCEDURE.

Note: If you have any questions or require further instructions, or would like training, contact nVent ERICO at 1-800-447-7245 or visit www.nVent.com

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VI. WELDING PROCEDURE FOR nVent ERICO Cadweld PLUS (PLUS Cup with Yellow Center Dot)

⚠ WARNING: Correctly positioning the mold against the rail is critical for safety and success in making a connection. There must be no clearances between the mold that contains the weld cavity and the rail surface; if a clearance is present or mold is worn, the mold should be discarded and a new one used. (Molds can generally be used for up to 50 welds) The exothermic reaction reaches a temperature in excess of 4000°F, therefore great care must be exercised to avoid spillage of the molten metal. Failure to observe this warning may result in molten metal leakage onto the rail with the immediate risk of personal injury, and potentially serious structural damage to the rail.

1. After mold is properly positioned according to the connection specific instruction print(s):

⚠ CAUTION: Install only the specified welding material in the mold crucible. Use only the welding material size that is specified on the mold. nVent ERICO welding material (F80) is formulated specifically for use with rail steels.

2. Insert nVent ERICO Cadweld PLUS welding material cup into mold. **See Figure 14.**

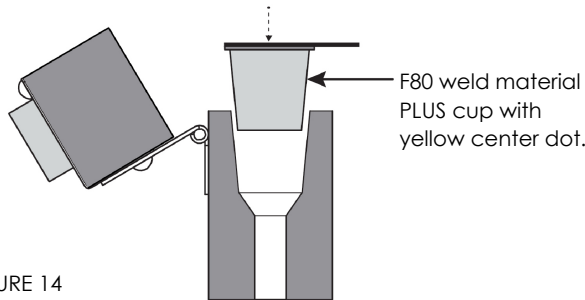


FIGURE 14

3. Attach Control Unit termination clip to ignition strip, align the strip with the ignitor strip slot and close the cover. **See Figure 15.**

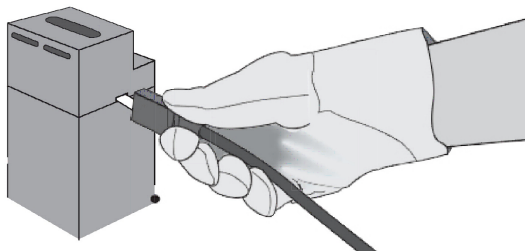


FIGURE 15

4. Position yourself upwind of the mold, on the field side of the rail. Press and hold Control Unit operator button until the ready light turns off and wait for ignition. **See Figure 16.**

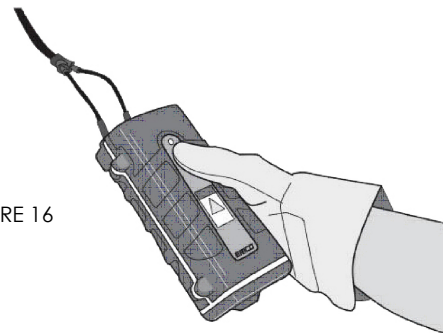


FIGURE 16

Release button to abort ignition process.
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⚠ CAUTION: Allow 15 seconds for mold cooling after the reaction. This will permit the molten metal to solidify. Then carefully disengage the welder device and pull the mold straight back from the rail. Failure to observe this may result in mold damage and its premature scrapping. Molds can generally be used for up to 50 welds.

5. Carefully open the mold cover and break up the slag in the crucible using the blade of the mold cleaning tool. Dump the slag and steel cup from the crucible and remove slag from the tap hole using the curved end of the mold cleaner. Dispose of the slag according to local regulations.
6. Unlock clamp and remove welder.
7. Check the molds for breakage or residual slag before proceeding with the next weld.

Note: If you have any questions or require further instructions, or would like training, contact nVent ERICO at 1-800-447-7245 or visit www.nVent.com.