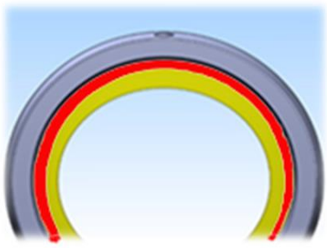
Avoidable Electrofusion Failure Modes

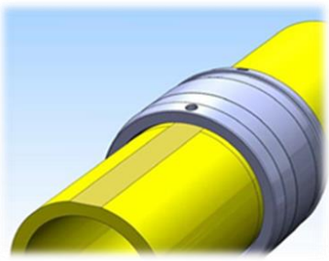
PRE-ASSEMBLY INSPECTION OF THE PIPE: Responsibilities for the Fusion Technician on-site include looking for identifiable manufacturing related anomalies and/or damage caused by common storage and material-handling related issues. This helps the Fusion Technician avoid non-installer related issues that can have a serious impact on the successful completion of an electrofusion joint!

Out-of-Spec Pipe

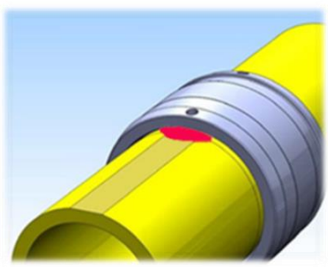
Electrofusion Couplers are manufactured to very tight ASTM tolerances. If the area where the coupler is being installed does not conform to the OD requirements of ASTM F714 in the area the EF Coupler is being installed; the melt flow being created in the fittings' fusion zone will be unable to effectively close the excessive gap in the annular space between the fitting and the undersized pipe surface. The result will be a loss of required interfacial pressure building up inside the fitting and could result in a failed fusion joint.



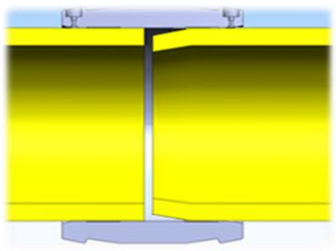
Flat Spots



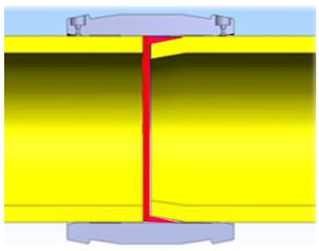
Flat-Spots and other surface anomalies are issues related to the manufacturing process. Damaged pipe surfaces can also be the result of improper transportation and handling, or from mishandling during warehousing and storage. If flat spots, unusual surface anomalies, or damaged spots exist in the area the EF Coupler is being installed, that exceed 10% of the minimum required pipe wall thickness; those areas must be cut back to where the pipe surface is in an acceptable condition and the pipe OD falls within tolerance.



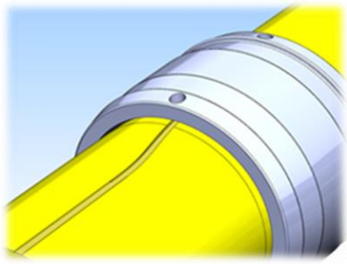
Excessive Toe-In



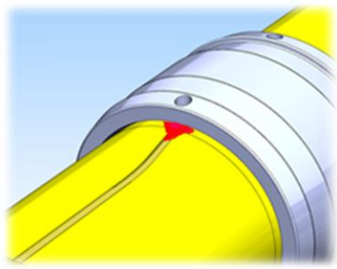
Excessive Toe-In on the end of a pipe where the EF Coupler is being installed, can create in an excessive gap in the center cold-zone of the EF Coupler being installed. If the gaps in the center cold-zone are too large, it may not be possible for the required interfacial pressures to buildup in the melt pool, and the result will be a sudden and excessive loss of interfacial pressure and molten material, If an excessive toe-in condition exists, the pipe end must be cut back to a point where the toe-in condition is removed.



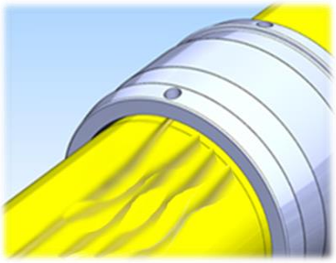
Gouges



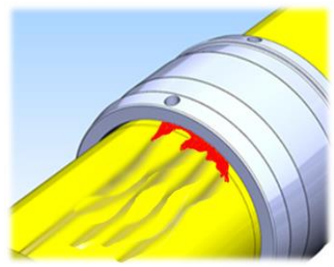
Gouges are a result of transportation, handling, and construction site issues. If gouges are found in the area where the EF Coupler is being installed that exceed 10% of the required pipe wall thickness, the pipe must be cut back to where the pipe surface is in an acceptable condition and the pipe OD falls within tolerance. Gouges that do not exceed 10% of the pipe wall thickness, may require extra attention when preparing the surface of the pipe.



Scratches



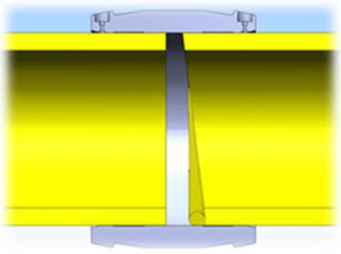
Gouges are a result of transportation, handling, and construction site issues. If excessive scratches are found in the area where the EF Coupler is being installed that exceed the 10% of the minimum required pipe wall thickness, that section of pipe must be cut back to where the pipe surface is in an acceptable condition and the pipe OD falls within tolerance.



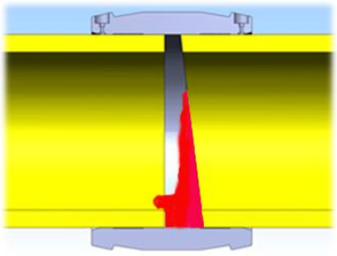
Avoidable Electrofusion Failure Modes

PAYING ATTENTION TO THE DETAILS DURING PIPE PREPARATION AND JOINT ASSEMBLY; helps the Fusion Technician on-site avoid installer related problems that can compromise an electrofusion joint assembly and have a serious impact on the successful completion of an electrofusion joint!

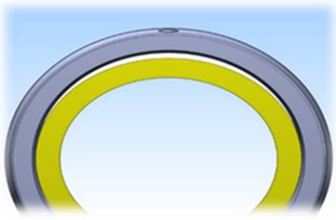
Pipe Ends Mis-Cut



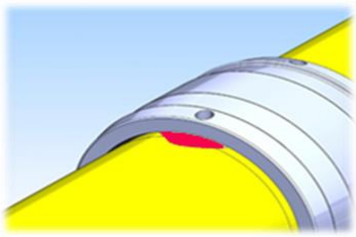
Pipe ends must be cut straight and square. Anything exceeding the acceptable +/- 3 degree deviation is considered a mis-cut assembly and may not be able to ensure full coverage of the heating coils and can result in an excessive gap that falls outside of the effective area of the center cold zone to contain the melt flow.



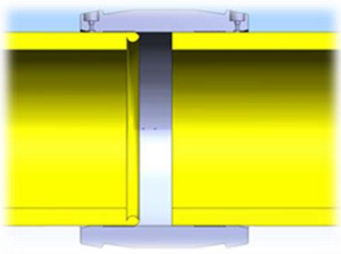
Failure to Re-Round



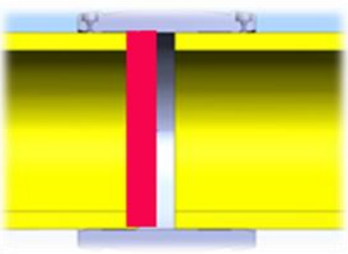
Out-of-round pipe can create excessive gaps in the area where an EF Couplers is being installed. As polyethylene heats up. it expands and closes the gap between the pipe surface and the fitting. If there is a gap in the fusion zone that exceeds more than the expansion of the material can close, the result will be la loss of interfacial pressure, and the expulsion of molten material at the outside ends of the coupling.



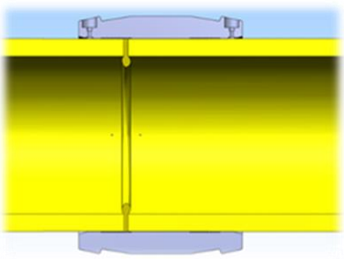
Pipe End Short-Stabbed



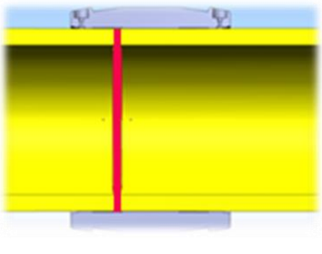
Pipe ends not properly inserted all the way into the center of the EF Coupler being installed, is called a Short Stab. As the melt pool expands in the fusion zone, molten material will flow over the exposed pipe around the short-stabbed area. The result will be uncontained movement of the melt flow that will cause shorting in the fusion coil and rapid over heating in the fusion zones.



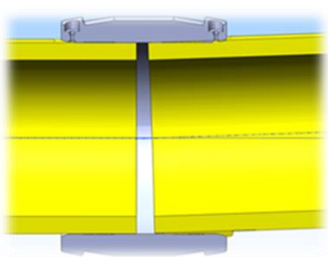
Pipe End Mis-Stabbed



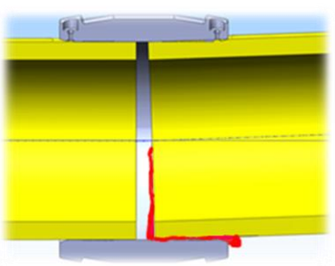
Pipe ends inserted beyond the center cold-zone of the EF Coupler being installed, causes the other side to be under inserted. This is called a Mis-Stab. As the polyethylene heats up and the melt pool expands, material will push through the gaps in the mis-stabbed area where the pipe ends meet. The result will be an uncontained movement of the melt flow that will cause shorting in the fusion coil and rapid over heating in the fusion zones.



Pipe End Mis-Aligned or Binding

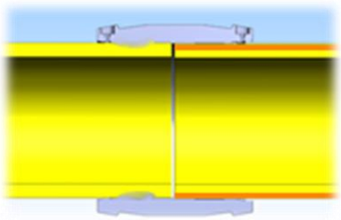


Electrofusion Joint assemblies must be in a straight, stress-free, and non-binding orientation during the fusion process. Unrestrained and/or unsupported pipe and joint assemblies create stresses in the fusion zone. The weight of the pipe, the fittings and other heavy system components, must remain supported and aligned to ensure that the area being fused stays straight, stable, immobile, and free of external stresses until the cooling time has been completed.

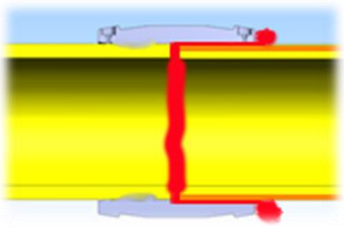


PAYING ATTENTION TO THE SPECIFIC REQUIREMENTS of pipe preparation and joint assembly; helps the Fusion Technician on-site avoid installer related problems that can seriously affect the successful completion of an electrofusion joint!

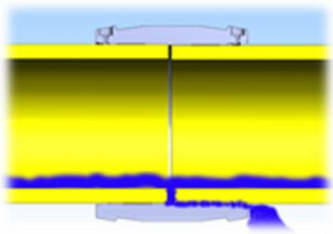
Unscraped or Improperly Scraped Pipe Surface



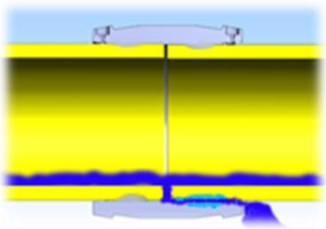
The #1 cause of all Electrofusion Joint Assembly Failures is improper Pipe Surface Preparation. If the surface of the pipe has not been peeled, or it has been improperly peeled, and virgin resin is not exposed in the fusion zone; the oxidation layer on the pipes surface is enough to create an impenetrable barrier that will impede the necessary molecular boding to take place. Resulting in a joint that will either leak and/or fail.



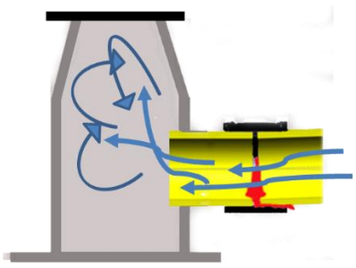
Water Flowing in the Fusion Zone



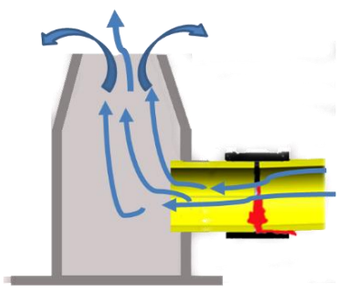
Water flowing or trickling over the fusion coils of the EF Coupler being installed is unacceptable. Water not only creates a layer of impenetrable contamination between the pipe surface and the fitting; it also results in the water turning into steam when coming into contact with the hot fusion coil, which in turn creates a void in the fusion zone as the steam expands which can result in it becoming a leak path.



Restricting Airflow in Vertical Applications



When fusing an EF coupler into, or part of a vertical application, you must take steps to restrict airflow through the joint assembly. The Fusion Technician on-site must also ensure that the EF joint is correctly assembled, not short stabbed, mis-stabbed or in a binding situation. Heat generated in the fusion zone can become accentuated if the molten material escapes and is exposed to an increase in airflow.



You must take steps to minimize the potential increase in airflow through the fusion area by covering the opening with a tarp or piece of plywood to avoid creating a "rocket stove" effect.