



Designation: D8580 – 24

Standard Practice for Wedge Welding of Polymeric Geomembranes¹

This standard is issued under the fixed designation D8580; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ϵ) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice is applicable for the hot wedge welding of geomembrane liners produced from polymer materials in sealing of geotechnical and hydraulic engineering systems.

1.2 Welding devices may include hot wedge or hot air wedge welders.

1.3 In this practice, the aim is to provide information on and give insight into the importance of factors that influence the quality and durability of geomembrane welds. This standard covers all weldable thermoplastic geomembranes, including of reinforced materials.

1.4 Extrusion welding and the welding of bituminous and non-thermoplastic geomembranes are not covered.

1.5 The work should only be carried out by operators with demonstrated competency in the welding of polymeric geomembranes. Only equipment designed for the welding of polymeric geomembranes shall be used. All operators of such equipment shall have training specific to the equipment and geomembranes being used.

1.6 *Units*—The values stated in inch-pound units are to be regarded as the standard. The values given in parentheses are mathematical conversions to SI units that are provided for information only and are not considered standard.

1.7 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety, health, and environmental practices and determine the applicability of regulatory limitations prior to use.*

1.8 *This international standard was developed in accordance with internationally recognized principles on standardization established in the Decision on Principles for the Development of International Standards, Guides and Recommendations issued by the World Trade Organization Technical Barriers to Trade (TBT) Committee.*

2. Referenced Documents

2.1 *ASTM Standards:*²

D4437/D4437M Practice for Nondestructive Testing (NDT) for Determining the Integrity of Seams Used in Joining Flexible Polymeric Sheet Geomembranes

D5820 Practice for Pressurized Air Channel Evaluation of Dual-Seamed Geomembranes

D6392 Test Method for Determining the Integrity of Nonreinforced Geomembrane Seams Produced Using Thermo-Fusion Methods

D7177/D7177M Specification for Air Channel Evaluation of Polyvinyl Chloride (PVC) Dual Track Seamed Geomembranes

D7747/D7747M Test Method for Determining Integrity of Seams Produced Using Thermo-Fusion Methods for Reinforced Geomembranes by the Strip Tensile Method

D8468 Practice for Data Recording Procedure for Welding Devices Used to Produce Thermal Fusion Welds in Geomembrane Systems

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *contour/contact rollers or sometimes referred to as dwell rollers, n*—a reference to the system that guides the geomembrane over the heat source within the welding device in a controlled manner.

3.1.1.1 *Discussion*—This controlled manner is important to ensure consistency in the welding process. For these reasons, the setup of the contour/contact system is critical for the correct setup of the welding device.

3.1.2 *dew point, n*—the temperature at which air becomes saturated with moisture and can't hold any more water vapor. When the air cools down to the dew point, water vapor in the air starts to condense into tiny water droplets.

3.1.2.1 *Discussion*—At this point, the air cannot hold more water in the gas form. The temperature at which this condensation begins to happen is known as the dew point.

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² For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at www.astm.org/contact. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

3.1.3 *dual-track seam, n*—a type of welding process in which two parallel seams are simultaneously created joining two overlapped geomembranes together.

3.1.3.1 *Discussion*—The two parallel seams have an unwelded space between them. This unwelded space can then be used to carry out an air pressure test.

3.1.4 *single-track seam, n*—a type of welding process in which joining two overlapped geomembranes together is achieved with a single, continuous track, that is, without leaving any air channel.

3.1.4.1 *Discussion*—Single-track seams are as wide as the nip roller in the welding device.

3.1.5 *geomembrane welding, v*—the process of joining two or more geomembrane sheets using a combination of temperature, speed, and pressure (T, S, and P).

3.1.6 *hot air wedge, n*—a hot air heated wedge in the welding device that transfers heat to the geomembrane during the fusion welding process.

3.1.7 *hot wedge, n*—an electrically heated wedge in the welding device that transfers heat to the geomembrane during the fusion welding process.

3.1.8 *nip rollers or pressure rollers, n*—rollers of the welding device that simultaneously provide the pressure and forward motion.

3.1.9 *squeeze-out, n*—molten polymer material that may be produced during the seaming process. Squeeze-out does not determine the quality of the weld and is dependent upon the type of material being welded.

3.1.9.1 *Discussion*—The squeeze-out, when present, is the excess molten polymer pushed out at the sides of the dual or single-track seam during the seaming process. Excessive squeeze-out can also be an indicator of incorrect welding parameters.

3.1.10 *tensiometer test, n*—a destructive test using the peel and shear test methods to determine the quality and strength of a seam.

3.1.11 *trial welds, n*—the process of producing test welds using the material to be welded under the same conditions in which the welding will take place so that ideal welding parameters can be established and verified using current testing standards.

3.1.12 *welding device, n*—the hot wedge welder or hot air welder used in the welding process that involves the use of heat, speed, and pressure to fusion weld two materials together.

4. Significance and Use

4.1 The purpose of this practice is to provide general guidance on how to assemble polymeric geomembranes using hot air or electrically heated wedge welder, including the influence of temperature, speed, and pressure (T, S, and P), preparation/cleaning of the surface, and so forth, to establish the quality and durability of the assembly.

5. Welding Device

5.1 For a welding device to be able to deliver consistent and reliable welded seams, the welding parameters (T, S, and P) should be precisely controlled.

5.1.1 The heating control system should incorporate closed-loop control standards to maintain consistency of the welding temperature.

5.1.2 The welding speed drive control should incorporate closed-loop control standards to maintain consistency of the welding speed.

5.1.3 The pressure system should incorporate a load cell or measuring system to show and enable reproducible consistency of the welding pressure.

5.2 *General Conditions*—The welding device accuracy shall be documented as per the manufacturer's guidelines.

5.2.1 It is desirable that the welding device incorporate a data acquisition system as per Practice D8468. Such a system enables automated data acquisition throughout the entire length of the seam, providing additional opportunity to detect areas with higher risk of defects. Furthermore, such welding data log files are useful for post-welding analysis.

5.2.2 All rollers and movable parts of the welding device shall always be able to move freely as per the manufacturer's guidelines.

5.2.3 Worn parts that are outside of the manufacturer's tolerance shall be exchanged and the welding device shall be serviced by an authorized service agent on a regular basis as per the manufacturer's guidelines.

5.2.4 All parts of the welding device that come into contact with the material to be welded shall have no sharp edges. Sharp edges on any parts of the machine, in particular the hot wedge and nip/pressure rollers, will cause notching of the welded material and have a negative effect on the long-term weld strength. The minimum radius on all edges that have contact with the geomembrane shall be no less than 5/64 in. (2.0 mm).

5.2.5 All welding devices are powered by electricity. As such, it is important to maintain minimum electrical cable length and capacity to meet the voltage and power requirements of the welding device used as per the manufacturer's guidelines. Cable lengths and the number of connections should always be kept to a minimum.

5.2.6 The ranges of welding parameters reported in Table 1 are typically achievable with modern welding equipment and have been shown to provide acceptable weld results.

TABLE 1 Typical Weld Parameters Ranges^A

Temperature	Speed	Pressure
Hot wedge 540 °F–860 °F (280 °C–460 °C)	4.9 ft/min–14.8 ft/min (1.5 m/min–4.5 m/min)	4.5 lb/ft–9 lb/ft (20 N/mm–40 N/mm) per mm nip roller width
Hot air wedge 680 °F–1040 °F (360 °C–560 °C)		

^A Typically, hot air temperatures are higher than hot wedge temperatures because of the different nature of heat transfer. Speed and pressure values apply for both wedge types and are taken from the same table.