Carbofol®

Carbofol® HDPE geomembranes – excellent welding properties

Technical Note

Naue

Why is welding performance important for geomembranes?

To establish a fully impermeable sealing layer from single geomembrane panels, it is mandatory to connect the panels by welding. For HDPE geomembranes, the most common methods are heated wedge welding and hot gas extrusion welding, with heated wedge welding being the preferred method due to being safer, faster and allowing for additional quality control measures such as air pressure test as per ASTM D5820.

Figure 1: Welding machine in operation on Carbofol®

Figure 2: Close-up of heated wedge

All expert literature and publications on this topic emphasize that flawless geomembrane welds are crucial for the overall performance of lining systems and that the weld is the most neuralgic zone when it comes to the statistical probability of failure.

This becomes even more decisive in applications where the geomembrane has to perform over very long periods to protect the environment from pollutants, for example, in lining systems for tailings and landfills.

What can be done to improve welding performance?

Saving welds
The plain and simple method for reducing risks in lining projects that contain large areas with environmentally sensitive material is to avoid welding wherever possible. A 7.5m wide Carbofol® roll covers 50% more area without welding than a comparable 5.0m wide roll, ultimately reducing the risk of weld failures and decreasing the time needed for performing welding works and subsequent testing.

Care for clean welds
Additional measures, such as weld protection strips that prevent dust/soil from sticking to the weld area and which are removed just before the welding process, reduce additional cleaning works and the risk that foreign material is embedded in the weld.

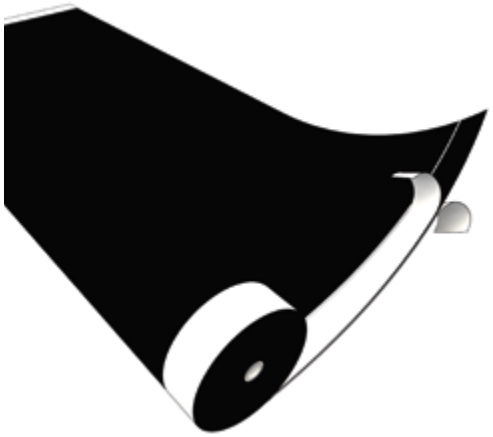

Figure 3: Carbofol® with removable weld protection strips

Heated wedge welding with double wedge where possible
Naue is proud to say that Carbofol® BF/TF allows for heated wedge welding even in the structured areas, for the geomembrane and the structure are of identical HDPE resin and masterbatch. They are coming in the same extrusion process. Independent testing has confirmed that good weld quality can be achieved when welding in Carbofol® structured areas without grinding – provided the installer has expert knowledge on welding and correct adaption of welding parameters. This is not possible with the most common geomembrane structures.

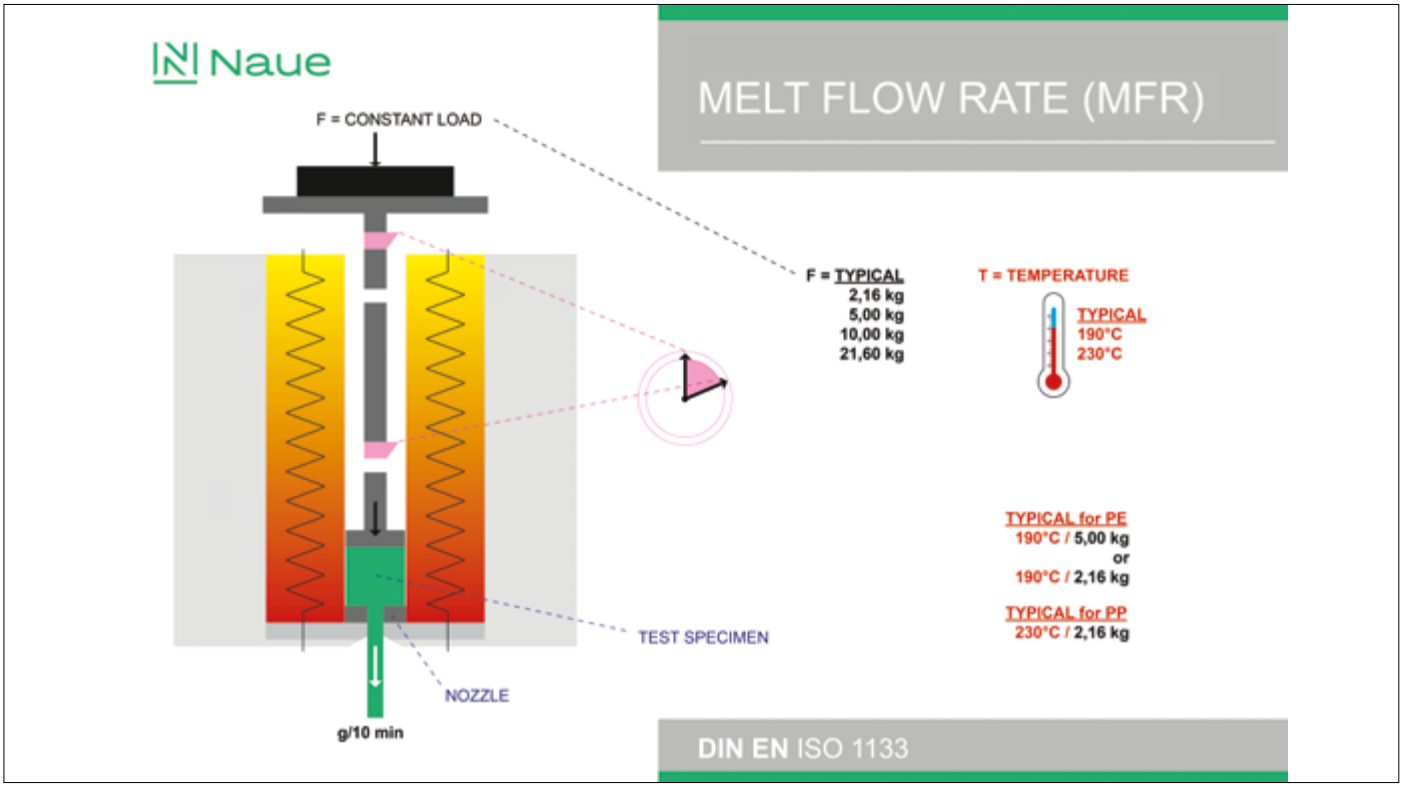

Figure 4: Melt flow rate testing on resins and geomembranes

Using high-quality resin and masterbatch with good melting performance

To allow for good welding performance, it is important to have a good resin composition that shows good rheologic behaviour when exposed to temperature. When heated, the material should act viscous and allow the mixing of upper geomembrane and lower geomembrane melt. The Melt Flow Rate is an indicator to qualify the rheologic behaviour of thermoplastics under heat and pressure conditions.

While there are usually few requirements on the Melt Flow Rate (MFR or Melt Flow Index MFI respectively) in standards, we at Naue GmbH & Co. KG ensure that our Carbofol® geomembranes are always in a range of MFR that allows good welding.

It should be noted that recent research gives evidence for the depletion of antioxidants and loss of ductility for welds carried out at very high weld temperatures, which are commonly needed for HDPE materials with low MFR.

Installers of Carbofol® geomembranes can rely on positive welding results even with comparably low welding temperatures (usually around 380 °C), which lowers energy consumption and increases safety due to less energy adsorption in the material – and subsequently less depletion of antioxidant and stress crack resistance.

What are the advantages for Naue customers?

All the criteria mentioned above that are considered in our development and resin composition of Carbofol® geomembranes target for higher safety of welds (and subsequently of the whole lining system), less time consumption when welding and testing and higher lifetime.

That said, Carbofol® is the top choice, especially for projects that have to endure long service life and contain environmentally sensitive substances such as mining residues or waste landfills.