Brandenburger Installation manual manhole liner – BB$^{2.5}$ *VERTICAL*

1 Vehicles / UV system

For fast and flexible work, we recommend a truck equipped with a tail lift. This can be used to prepare the manhole liner as well as for the UV system.

Also needed:

- Compressor: >4,000l/min at 0.8 bar
- Lifting device: e.g. Manticor or crane on truck with a minimum lifting height = manhole depth + 2m
- Level, clean working surface with a width of approx. 2m and a length = manhole depth +2m

The work surface must be protected from direct sunlight and the effects of the weather.

The UV system must have at least the following characteristics

- 3 * 650 Watt up to a maximum of 6 * 1,000W
- UV core with camera
- Controlled train speed
- Curing control with data logging (pressure, draw speed, lamp control, temperature)
- "Manhole packer" with camera
- Proof of the operating hours of the radiators

2 Transport and storage of the liners

In the light-tight transport boxes, the GRP tube liners can be stored at a storage temperature of +6°C to +25°C for up to 12 weeks from the production date. The transport boxes must be protected from direct weather influences, especially direct sunlight, heat sources, moisture and artificial UV light. The transport and storage conditions must be documented throughout, especially the temperature.

3 Preparation of the manhole

3.1 Measuring the liner

Measure the manhole depth and diameter again and compare them with the information in the documents accompanying the liner. This is to prevent e.g. the wrong DN of the liner or pressure bag being used.

3.2 Pre-profiling

Milling of inlets, caulking of channels, removal of crampons, cleaning of the manhole.

All protruding installation parts must be removed. The holes created by removing the built-in parts must be closed with repair mortar.

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3.3 Dewatering

- All inlets and the holding area are to be closed off

3.4 Prepare the bottom area of the manhole

- The floor of the chamber must be lined with sliding foil. The foil must be adapted to the manhole geometry at the corners by cutting it off. This is to prevent damage to the pressure bag and the liner material, as well as to allow good sliding into the manhole corner (berm - manhole wall).
- The holding and inlets >DN200 are covered separately with sliding foil. Size = 3 * DN. This is to prevent excessive bulging of the manhole liner into the opening.
- To align the manhole liner, mark the course of the channel with coloured tape.
- The film must also be wetted with silicone-free lubricant.

3.5 Securing the packer

During calibration and curing, the liner is under internal pressure. In rare cases, in the event of a deflagration, this pressure can increase considerably. For this reason, the packer must be secured against blowing off and flying away. In order to be able to secure the packer when calibrating the manhole liner, at least 3 pieces of tension belts with a respective load-bearing capacity of at least 2,500daN are doweled into the cone by means of impact rivets (at least 3 pieces each with Ø6mm).

3.6 Measuring the liner length

- The manhole depth is measured from the bottom of the berm to the top of the ground. The manhole liner then requires an additional 50 - 60 cm for the installation of the packer.
- The straight length from the bottom of the berm to the top of the ground is marked on the outside of the liner. This will later serve as the installation depth when lowering the liner into the manhole.

4 Preparing the liner for installation

4.1 Replacing the towing rope

The textile strap of the manhole liner pre-installed in production is replaced by a pull rope 8-10mm. The purpose of this is to pull in the second inner liner to be inserted at the knot from top to bottom. Do not throw away the removed textile strap.

4.2 Prepare pressure bag or second inner foil

- The first metre of the second inner foil (pressure bag) is folded like a fan, secured with a calf tie, folded over, and secured again with 2 cable ties.
- The cable ties are to be covered with textile adhesive tape in each case
- The 2nd inner foil (pressure bag) must be moistened with **silicone-free** lubricant before being pulled in. E.g., with a cloth. Do not spray.

This serves to improve the gliding properties of the second inner film (pressure bag) to the production inner film.

- The pull rope is now attached to the knot of the second inner foil.

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4.3 Pull the second foil into the manhole liner

- It is essential to protect the second inner film from damage and soiling. To do this, the roll can be hung up, for example (see picture).
- It is folded lengthwise and pulled smoothly into the manhole liner. The foil is pulled out at the bottom approx. 60 cm (DN800) and approx. 80 cm (DN1000) beyond the cut edge of the manhole liner (distance incl. knot to the cut edge of the liner).
- At the upper end of the liner, at the packer, the second inner foil is cut off approx. 20cm above the cut edge of the manhole liner. The excess is then put over the manhole liner in the “upper” area (later seat of the packer). This prevents the inner film from slipping into the liner.

4.4 Set packer

- A sleeve (DN630) must always be used. This is integrated into the packer and projects a maximum of 10 cm into the cylindrical entry area of the manhole. (Under no circumstances may the sleeve extend into the cone).
- The packer is inserted in the “upper” area of the manhole liner. This is the area where the second inner liner has been turned over. The packer is fixed and secured with 3 tension straps as standard (same procedure as for the standard liner).

4.5 Preparation of the lower liner end

- The corners of the flat-lying manhole liner are cut diagonally to 15cm on one edge length. (See Fig. 4.7 Sewing)
- In the area of the bottom, the outer foil of the manhole liner is cut open by approx. 80 cm at the weld seam and folded back.
- 50cm of the longitudinal bands will be cut and removed in this area.
- The inner sides of the folded back foils are wetted with silicone-free lubricant and then folded back onto the laminate. The outer edges of the foils are taped.

4.6 Unfolding the support bag

- The packer is closed with the lid in order to slightly pressurise the pressure bag with air. The part of the pressure bag that looks out of the manhole liner at the bottom must be turned inwards by hand by approx. 60 cm. This is done to achieve a crease-free installation in the berm area. Then turn off the air supply and vent the liner.

4.7 Sewing

- The lower section is sewn with a needle and with the previously removed textile tape.
  (No mason’s cord)
- At least 10 stitches at a maximum distance of 10cm. Distance from the cut edge 5 - 7cm
  (The holes can be pre-drilled with a Ø5mm drill bit if necessary).
- The ends of the ribbon are to be knotted.

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5 Installation of the liner

5.1 Lift and position the liner in the manhole

- The liner can be inserted gently. It can be easily folded for this purpose. Compressions and jerky release are to be avoided.
- Attach the packer to the hoist with a spreader bar. Observe the load capacity of the crane and sling.
- The manhole liner is to be installed oriented so that the seam (flat width) is aligned along the channel.
- The manhole liner must not hang on the crane or in the manhole for longer than 5 minutes. Otherwise the windings can slip axially after this time.
- The liner is lowered into the manhole until it comes into contact with the channel. The marking that was applied to the outside of the liner when measuring its length serves as a check.

5.2 Inserting the light source

- Close the packer lid pressure-tight and place the liner with slight overpressure without stretching it. This serves as preparation to be able to use the light source without damaging the support bag.
- Check the alignment: Is the seam aligned with the channel? Correct position if necessary.
- Release all pressure from the manhole liner.
- Open the packer lid and secure it to the hoist. Fix the curing cable.
- Connect the light source to the cable.
- The light source is placed in the manhole liner floating and without a guide. The curing cable is guided via a deflection pulley in the lifting device.
- Close the packer lid pressure-tight

5.3 Securing the packer

- The packer shall be equipped with the tools described in point 3.5. to secure the packer.

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6 Calibrating the manhole liner

- The occupational health and safety regulations must be complied with.
- Start with 150mbar. 10 minutes holding time
- Increase the pressure in 50mBar steps and a respective holding time of 5 minutes to at least 600mBar, maximum 800mBar.

7 Curing

7.1 Set the reference point of the light chain

- The light source is pulled to the stop of the packer to mark the zero point.
- The QL is then lowered to its end stop on the bottom of the manhole liner. This can also be checked via the camera. The QL must not touch the bottom under any circumstances (inner foil can be damaged, fire hazard!).
- The QL is pulled up from the bottom to the packer at the speeds given below.

7.2 Curing speed

- The values given are **recommended guide values** for the maximum curing speed. It is the responsibility of the person responsible for the installation to adapt the curing speed to the site conditions.
- The curing parameters shall be continuously documented.
- When curing with vinyl ester resin, reduce the speed by 30 - 35 %.
- All parameters are non-binding recommendations based on general experience and must be documented continuously during curing. The achievement of the contractually presumed purpose and the contractual requirements of the manhole liners depends to a large extent on the correct installation of the liners in the old manhole. Unless expressly agreed otherwise, we shall not be involved in the installation of the manhole liners. In this case we have no insight into the execution of the installation. In the event of any warranty claims, it is necessary for us to check the correct installation of the manhole liner in order to be able to assess the damage and any possible cause of damage due to incorrect installation. It is therefore the customer's responsibility to ensure proper, accurate and complete documentation of the liner installation.

7.2.1 Recommended times for a DN1000 standard round concrete manhole:

- All lamps are ignited simultaneously. Afterwards, a standing time of 10 - 15 minutes is observed in this position.
- IMS 3x650W ≤10cm/min
- PK 4x1.000W ≤30cm/min
- IBG 3x1.000W ≤25cm/min
- A standing time of 5 - 7 minutes is observed at the top of the packer. After that, all lamps are switched off.

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7.2.2 Recommended times for a DN800 standard round concrete manhole:

- All lamps are ignited simultaneously. Afterwards, a standing time of 10 - 15 minutes is observed in this position.
- IMS 3x650W ≤15cm/min
- PK 4x1.000W ≤35cm/min
- IBG 3x1.000W ≤30cm/min
- A standing time of 4 - 6 minutes is observed at the top of the packer. After that, all lamps are switched off.

8 Expansion

- The light source is secured at the high point with the lamps switched off. The pressure is released to 150mBar and held for at least 15 minutes to cool the liner and light source.
- The pressure is then completely released, the packer lid is opened and the light source is removed from the liner.
- Loosen the tension straps and securing straps on the packer and remove the packer from the liner.
- The second inner foil is pulled out of the liner
- The protrusion of the liner up to the upper edge of the road is cut off with an angle grinder (observe work safety such as PPE, protective goggles, respiratory protection, gloves and overalls). The liner is then trimmed flush with the manhole ring so that the manhole cover can be inserted.
- Afterwards, in compliance with the usual safety regulations, you can enter the manhole and, from the bottom, loosen and pull out the first inner foil on the hardened liner, as well as cut back the contours of the channel and open inlets from below.

9 Safety instructions

For all work, the safety instructions must be observed, see attachment:

- Safety instructions Einbau Schachtliner **BB**$^{2.5}$ ***VERTICAL*** vom 20.04.2023
- Operating instructions Installation manhole liner, 07/2022

Brandenburger

Brandenburger Liner accepts no liability for the accuracy, completeness and actuality of the data transmitted.

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