

GENERAL:

The scope of this document is to provide instruction for the installation of waterproofing of concrete steam chases, tunnels and manholes.

DESIGN GUIDELINES:

A. General

1. Outside surfaces of all subgrade floors, walls and lids of new utility chase and walk tunnels, and subgrade walls, roof and risers of new manholes shall be waterproofed.
2. New concrete lids installed on existing chase or tunnel shall be waterproofed.
3. Included in this document is an Alternate Waterproofing System that should be considered in cases where the manholes, tunnels or pipe chases are located in very wet locations, such as near or below the water table.

B. Materials

1. Concrete Repair Materials - As recommended by waterproofing manufacturer.
2. Waterstops
 - 2.1. Waterstops for use in manholes and at base of utility chase/tunnel walls, and expansion joints shall be 6", PVC, serrated with center bulb. Waterstop to be Style 703 as manufactured by Greenstreak, St. Louis MO or approved equal.
 - 2.2. Waterstops for locations where the chase/tunnel abuts structures shall be a Split Flange - 6", PVC serrated with center bulb for new to new installations. Waterstop to be Style 723 as manufactured by Greenstreak, St. Louis MO or approved equal. For new to existing installations waterstop shall be a Style 609 as manufactured by Greenstreak, St. Louis MO or approved equal.
 - 2.3. Waterstops for construction joints shall be 6", PVC, serrated. Waterstop to be Style 782 as manufactured by Greenstreak, St. Louis MO or approved equal.
 - 2.4. Waterstops for the precast lid to wall connection shall be Butyl-Rubber sealant. Waterstop to be Conseal CS-102 or approved equal.
3. Pre Applied sheet Waterproofing
 - 3.1. Provide Preprufe 300R membrane by Grace Construction Products or approved equal. Pre-applied integrally bonded sheet waterproofing membrane: 1.2 mm nominal thickness composite sheet membrane comprising .8 mm of high density polyethylene film, and layers of specially formulated synthetic adhesive layers. The membrane shall form an integral and permanent bond to poured concrete to prevent water migration at the interface of the membrane and structural concrete. Tape and other accessories specified or acceptable to manufacturer of pre-applied waterproofing membrane.
4. Self-Adhesive Waterproofing Membrane
 - 4.1. Self-adhesive waterproofing membrane for use to transition from pre-applied sheet waterproofing to hot applied rubberized asphalt waterproofing. Provide sheet applied, self-adhered waterproofing membrane Blueskin WP200 by

Henry Company or approved equal. Self-adhesive waterproofing membrane shall have the following physical properties:

- 4.1.1. Thickness: 1.5 mm (60 mils) min.
 - 4.1.2. Flexibility: Pass @ -40 degrees C to ASTM D1970
 - 4.1.3. Vapor permeance: 2.8 ng/Pa.s.m² (.05 perms) to ASTM E96,
 - 4.1.4. Tensile strength (membrane): 2.24 MPa to ASTM D412,
 - 4.1.5. Tensile strength (film): 34.5 MPa to ASTM D882,
 - 4.1.6. Elongation: 300% to ASTM D412,
 - 4.1.7. Puncture resistance: 222 N min. to ASTM E154.
5. Hot Applied Rubberized Asphalt Waterproofing
- 5.1. Components and membrane materials must be obtained as a single source from the membrane manufacturer to ensure total system compatibility and integrity. Provide Henry Company 790-11 SBS modified hot applied rubberized asphalt or approved equal. Rubberized asphalt waterproofing shall have the following qualities:
 - 5.1.1. Solids Content: 100%;
 - 5.1.2. Low Temperature Flexibility and Adhesion: No cracking, delamination or loss of adhesion @ 13 degrees F in accordance with CGSB 37-GP-50-M89;
 - 5.1.3. Flow (1/8 inch film on 75% angle for 5 hours @ 140 degrees F): No flow in accordance with ASTM D1191;
 - 5.1.4. Cone Penetration: More than 10 @ 32 degrees F, less than 110 @ 77 degrees F, less than 200 @ 122 degrees F in accordance with ASTM D1191;
 - 5.1.5. Water Absorption: Gain of 0.09g in accordance with CGSB 37-GP-50-M89;
 - 5.1.6. Flash Point (Open Cup): 545 degrees F in accordance with ASTM D92;
 - 5.1.7. Water Vapor Permeance (3mm Film): 0.01 perms in accordance with ASTM E96 Procedure A and 0.02 perms in accordance with ASTM E96 Procedure E.
 - 5.1.8. Ratio of Toughness to Peak Load: 0.04 min. in accordance with CGSB 37-GP-50-M89.
 - 5.1.9. Toughness: 9.2J in accordance with CGSB 37-GP-50-M89.
 - 5.1.10. Crack Bridging Capability: No cracking, splitting or loss of adhesion in accordance with CGSB 37-GP-50-M89.
 - 5.1.11. Heat Stability (5 hours @ 390 degrees F): Meets flow, penetration and low temperature flexibility in accordance with CGSB 37-GP-50-M89.
6. Hot Rubberized Asphalt Primer
- 6.1. Solvent based, synthetic rubber adhesive for hot applied rubberized asphalt membranes. Henry HE93018 polymer modified adhesive or approved equal.
7. Self adhered waterproofing primer
- 7.1. Polymer emulsion based primer for self-adhesive membranes. Henry Aquatac primer or approved equal. Self-adhesive waterproofing primer shall have the following physical properties:
 - 7.1.1. Color: Aqua
 - 7.1.2. Solids by Volume: 53%
 - 7.1.3. Weight: 8.3 lbs/gal
 - 7.1.4. Application Temperature: 25F to 104F
 - 7.1.5. Maximum VOC: 100 g/L

7.1.6. Service temperature -40F to 150F

8. Neoprene Flashing

8.1. Neoprene flashing sheets is used with 790-11 hot rubberized asphalt membrane at expansion joints and exposed flashing details. Neoprene flashing shall be Henry HE850AA or approved equal and shall have the following physical properties:

8.1.1. Brittleness Point: -40F

8.1.2. Color: Black

8.1.3. Elongation (Initial) ASTM D412 – 300%

8.1.4. Tear Resistance (ASTM D624 Die C) 125 lbs/in min

8.1.5. Tensile strength, membrane: (ASTM D412 Die C) 1800 psi min

8.1.6. Thickness: 60 mils

9. Fabric Reinforcement

9.1. Polyester fabric reinforcement sheet as supplied by Henry, an inorganic spun bonded polyester fabric sheet with sufficient porosity to allow good interplay bonding between layers of waterproofing membrane.

10. Precast Chase Lid to Cast-in-Place Chase Wall Interface Waterproofing

10.1. Waterproofing shall be Con-Seal CS-102 Butyl Rubber Sealant or MU Engineer Approved Equal.

10.2. One continuous strip centered on top of chase wall shall be installed per manufacturer's instructions.

11. Termination Sealant

11.1. Joint sealant shall be Henry HE925 BES moisture cure sealant for construction joints.

12. Termination Bars

12.1. Termination bars shall be continuous stainless steel, 1/8" x 1" in size and shall be pre-drilled for non-corrosive screw attachment on a maximum of 8" centers.

13. Drainage Pipe

13.1. 6", schedule 80, perforated PVC piping with filter sock.

14. Protection Sheet

14.1. Provide Henry G100S/S Protection sheet or approved equal for top of steam chases, tunnels and manholes.

15. Drainage Board

15.1. Provide Henry DB520 drainage board or approved equal. Drainage board shall have the following properties:

15.1.1. Thickness: 7/16" thick

15.1.2. Compressive strength: 15,000 lb/sq.ft.

15.1.3. Flow rate: 150 gpm/sq.ft.

15.1.4. Backing sheet: Polymeric backing film for contact with softer waterproofing membranes.

16. Cold Applied Waterproofing (used with MU permission, only in certain circumstances)

16.1. Cold applied waterproofing to be used with MU permission only in certain circumstances such as space constraints and time delays not allowing hot applied product on "green" concrete. Cold applied waterproofing shall be Henry CM100 or engineer approved equal and shall have the following physical properties:

16.1.1. Conforms to ASTM C 836

16.1.2. Solvent content: 0%

16.1.3. Non Flammable, Flash point > 450 F,

- 16.1.4. Elongation: >500%
- 16.1.5. V.O.C. < 40 grams / Liter
- 16.1.6. Can be applied to "green" concrete.
- 17. Flashing and Crack Treatment Membrane (for cold applied applications)
 - 17.1. Flashing and crack treatment membrane shall be 990-25 Elastomeric flashing sheet as supplied by Henry, a butyl/EPDM type, elastomeric membrane having a thickness of 47 mils.

C. Installation

1. Delivery, Storage, and Handling
 - 1.1. Deliver materials and products in labeled packages. Store and handle in strict compliance with manufacturer's instructions, recommendations and material safety data sheets. Protect from damage from sunlight, weather, excessive temperatures and construction operations. Remove damaged material from the site and dispose of in accordance with applicable regulations.
 - 1.2. Protect primer, mastic and adhesive from moisture and potential sources of ignition.
 - 1.3. Store protection board flat and off the ground. Provide cover on top and all sides.
 - 1.4. Sequence deliveries to avoid delays and minimize on-site storage.
2. Typical waterproofing installation includes concrete repairs, joint caulking, waterstops, preapplied sheet waterproofing, hot applied waterproofing and protection board. Refer to manufacturer's literature for instructions on installation.
3. Primer - Apply primer as recommended by manufacturer and allow to dry prior to the application of the primary waterproofing membrane or membrane flashings.
4. Joint and Crack Treatment
 - 4.1. Joint sealers are required to establish and maintain airtight and waterproof continuous seals on a permanent basis, within recognized limitations of wear and aging.
 - 4.2. Joint Preparation
 - 4.2.1. Clean joint surfaces immediately before installation of sealants. Remove dirt, insecure coatings, moisture, oil, form release agents and other substances which could interfere with seal of sealant.
 - 4.3. Joint Size
 - 4.3.1. In general, depth shall not exceed one-half of the width or be less than 1/4".
 - 4.3.2. For joints in concrete depth can be equal to the width in joints up to 1/2" wide. Joints 1/2" to 1" wide shall have a depth of 1/2".
 - 4.3.3. When joint depth exceeds the above ratios, fill with back-up material to provide the proper depth when measured from the joint face.
 - 4.4. Application
 - 4.4.1. Employ only proven installation techniques, which will ensure that sealants are deposited in uniform, continuous ribbons without gaps or air pockets, with complete "wetting" of joint bond surfaces equally on opposite sides. Except as otherwise indicated, fill sealant rabbets to a slightly concave surface, slightly below adjoining surfaces. Where horizontal joints are between a horizontal surface and vertical surface, fill joint to form a slight cove, so that joint will not trap moisture and dirt.
 - 4.4.2. Install back-up material or joint filler to provide sealant depth

- required for a proper joint. Back-up material shall be of suitable size and shape so that it will fit into joint when compressed 25% to 50%. Sealants shall not be applied without back-up material and, if necessary, bond breaker strip. When installing back-up rod stock, roll the material into the joint to avoid stretching twisting or braiding.
- 4.4.3. Do not seal during damp or inclement weather, or when the ambient or surface temperature is below 40oF or higher than temperatures as recommended by sealant manufacturer.
 - 4.4.4. Do not allow sealants to overflow from confines of joints, or to spill onto adjoining work, or to migrate into voids of exposed finishes. Clean adjoining surfaces by whatever means may be necessary to eliminate evidence of spillage.
 - 4.5. Fill cracks with joint sealant per waterproofing material construction standards.
 - 4.6. Seal cracks and joints 1/16 inch to 1/8 inch in width with a 12 inch wide, 1/8 inch thick coat of hot rubberized asphalt membrane and a 6 inch wide strip of fabric reinforcement, centered over joint.
 - 4.7. Seal cracks and joints 1/8 inch to 1/2" inch in width with a 12 inch wide, 1/8 inch thick coat of hot rubberized asphalt membrane and a 6 inch wide strip of neoprene flashing centered over joint.
5. Application of Hot Rubberized Asphalt Membrane
 - 5.1. Ensure concrete is ready to receive hot applied rubberized asphalt membrane.
 - 5.2. Apply membrane smooth, free from air pockets, wrinkles or tears and to manufacturer's instructions. Ensure full bond of membrane to substrate
 - 5.3. Apply first layer of hot rubberized asphalt membrane evenly to a minimum thickness of 90 mils to form a continuous monolithic coating over horizontal and vertical surfaces including previously reinforced areas.
 - 5.4. Apply fabric reinforcing sheet and firmly press into first layer of hot membrane. Overlap fabric approximately 1/4 inch ensuring that a layer of membrane is present between overlaps. Apply second layer of membrane over the fabric to a minimum thickness of 1/8 inches providing a total thickness of 215 mils.
 6. Installation of Protection Course/Separation Sheet
 - 6.1. Protection shall be rolled onto hot applied rubberized asphalt membrane while still warm and tacky.
 - 6.2. Lap protection course 2 inches on side laps and 6 inches on end laps.
 - 6.3. Starting at the low points or drains lay the protection course membrane in full continuous sheets in a shingle pattern. Stager all end laps.
 7. Cast-in-place Concrete Substrates
 - 7.1. Do not proceed with installation until concrete has properly cured and dried. If recommended by the manufacturer, special primers may be used to allow priming and installation of hot applied waterproofing sooner than 7 days. Priming may begin as soon as the concrete will maintain structural integrity.
 - 7.2. Fill form tie rod holes with concrete and finish flush with surrounding surface.
 - 7.3. Repair bugholes over 13 mm (0.5 in.) in length and 6 mm (0.25 in.) deep and finish flush with surrounding surface.
 - 7.4. Remove scaling to sound, unaffected concrete and repair exposed area.
 - 7.5. Grind irregular construction joint to suitable flush surface.
 - 7.6. Treat joints and install flashing as recommended by waterproofing manufacturer.

8. Waterstops
 - 8.1. Waterstops shall be installed in strict accordance with manufacturer's recommendations with particular care being given to properly setting in adhesive and maintaining the required 2" minimum concrete coverage.
9. Cleaning and Protection
 - 9.1. Remove any masking materials after installation. Clean any stains on materials which would be exposed in the completed work.
 - 9.2. Protect completed membrane waterproofing from subsequent construction activities as recommended by manufacturer.
 - 9.3. Butt joint between precast lids shall be sealed immediately after placing lids in order to minimize water infiltration prior to applying waterproofing. Seal with horizontal joint sealant as specified.
10. Quality Assurance
 - 10.1. Installer shall be firm which has at least 3 years of experience in work of the type required by these Construction Standards.
 - 10.2. For each type of material required for the work of this section, provide primary materials which are the products of one manufacturer to the extent possible.
11. Project Conditions
 - 11.1. Perform work only when existing and forecasted weather conditions are within the limits established by the manufacturer of the materials and products used.
 - 11.2. Proceed with installation only when substrate construction and preparation work is complete and in condition to receive sheet membrane waterproofing.
12. Execution
 - 12.1. Refer to manufacturer's literature for requirements for preparation of substrates. Surfaces shall be structurally sound and free of voids, spalled area, loose aggregate and sharp protrusions. Remove contaminates such as grease, oil and wax from exposed surfaces. Remove dust, dirt, loose stone and debris. Use repair materials and methods which are acceptable to membrane manufacturer.
 - 12.2. All concrete waterproofing shall be fully placed and inspected by the owner prior to proceeding to the next step of installation. Owner shall receive 24 notice of inspection being required. These inspections for approval shall include;
 - 12.2.1. Substrate conditions and preparations
 - 12.2.2. Flashing installation
 - 12.2.3. Membrane installation
 - 12.2.4. Protection and drainage installation
13. Alternate Waterproofing System

In extremely wet locations drain piping shall be added to the waterproofing design. Refer to the construction standard drawings. The piping shall be routed to the nearest storm sewer utilizing a separate sump pump manhole when required.
14. Warranty: Provide written five (5) year material warranty for sheet membrane waterproofing issued by the membrane manufacturer upon completion of the work.

REFERENCES

336354 Detail-Manhole Waterproofing.dwg
336354 Detail-Steam Chase Waterproofing.dwg