

GENERAL:

The scope of this document is to provide instruction for the installation of concrete steam tunnels.

DESIGN GUIDELINES:

A. General

1. Existing Tunnels
 - 1.1. All demolition of existing chases, tunnels, sidewalks, curbs, equipment pads, streets, etc., shall be clearly defined.
 - 1.2. All required demolition of existing pipe, pipe insulation and equipment shall be clearly defined.
 - 1.3. All known asbestos demolition shall be labeled as such.
2. Walk-through tunnels shall be designed with all dimensions such as width, height, depth below grade, wall thickness, floor thickness and lid thickness fully defined.
3. Walk-through tunnels shall be designed with all materials of construction to be used clearly specified.
4. Tunnel shall be made with reinforced concrete with smooth surfaces either cast in place or precast.
5. The internal dimensions of the tunnel shall be designed to enclose the necessary equipment, allow for sufficient space for personnel to maintain, repair or replace equipment and to allow for planned future expansion of the steam system where appropriate. Internal dimensions of steam tunnels should never be smaller than 6' wide x 7' high. See drawing: "336347 Detail-Tunnel Structure.dwg".
6. Tunnels shall have means of removing water either by gravity drain to daylight or storm sewer, or by mechanical pumping.
7. Tunnels shall have mechanical ventilation sufficient to maintain a reduced humidity level and provide ambient air temperatures and quality for a safe working environment.
8. Tunnels shall have high temperature rated lighting.
9. Outside surfaces of all subgrade walls and roofs of new tunnels shall be waterproofed. See drawing: "336354 Detail-Steam Chase Waterproofing" and Section 336354 General Concrete Requirements – Waterproofing.

B. Material

1. Covers and Frames
 - 1.1. Manhole cover and frame shall be Bilco J2AL-H20 lockable aluminum lid. Frame shall be set in concrete per manufacturer's instructions.
 - 1.2. Vent cover and frame shall be cast iron, heavy duty, Neenah R-4373-6 with open grate.
2. Ladders
 - 2.1. Tunnels shall have permanently installed ladders constructed of welded carbon steel, hot dipped galvanized (minimum 2 oz./sq. ft.).

- 2.2. Rails shall be 2-1/2" x 1/2" bars. Rails shall be 18" apart.
- 2.3. Rungs shall be 3/4" diameter deformed reinforcing bars, ASTM A615, Grade 40, on 12" centers. Rungs shall be set in holes drilled in rails and welded in place. Through holes shall be plug welded and ground smooth.
- 2.4. Ladder shall have minimum clearance of 7" between vertical mounting surfaces and center of rung.
- 2.5. Side rails shall be fastened at the top and bottom with galvanized angle brackets.
- 2.6. Ladders with 20' vertical length or greater shall be equipped with a safety cage designed, fabricated and installed in accordance with OSHA requirements.
3. Structural Steel and Anchor Bolts
 - 3.1. Miscellaneous structural steel, plates, etc. for pipe supports, guides and anchors in tunnels shall be ASTM A36 of sizes and shapes needed. No tubular structural members allowed.
 - 3.2. All structural steel members and end plates shall be hot dipped galvanized. Any galvanizing damaged by welding or erection shall be repaired with cold galvanizing. Surface preparation shall include power disk sanding the abraded or welded area to bright metal.
 - 3.3. Miscellaneous plates and pipe used for supports/anchors shall be cleaned and painted with zinc rich paint.
 - 3.4. Expansion bolts and nuts used in connection with pipe support structures shall be 304 stainless steel, "Kwik Bolt II" as manufactured by Hilti Inc., Tulsa OK, approved equal. All are to be installed per manufacturer's written instructions.
4. Tunnel Electric
 - 4.1. Aluminum conduit and XHHW wire shall be used for feeding receptacles and junction boxes.
 - 4.2. Galvanized steel receptacle boxes with stainless steel covers shall be used in manholes and tunnels.
 - 4.3. Use NEMA 4X stainless steel junction boxes with stainless steel inner back panel and hinged gasketed door with "fast-operating" stainless steel clamps. Box shall be mounted to manhole wall on hot-dipped galvanized steel u-channel supports.

C. Installation

1. Formwork shall be constructed such that the finished concrete surfaces are free of any abrupt dimensional changes requiring extensive corrective work such as patching or grinding and that formed concrete will conform to dimensional tolerances.
2. All rebar shall be covered with at least 2" concrete cover.
3. All tunnels should be deep enough such that they can be waterproofed and covered with protective hardboard before landscaping is restored, or concrete sidewalks or drives are poured.
4. Welding and Brazing
 - 4.1 All welding, brazing, soldering and cutting work shall conform to applicable provisions of the following codes and requirements:
 - 4.1.1 American National Standards Institute (ANSI) B31.1 (latest) Power Piping and Addenda

- 4.1.2 American Welding Society (AWS) D1.1 (latest) Structural Welding Code
- 4.2 Welding and brazing shall be performed only by skilled welders. Welders, and welding and brazing procedures shall be qualified in accordance with Section IX of the ASME Boiler and Pressure Vessel Code. A record shall be maintained on the job showing the date and results of qualification test for each welder employed on the job. One certified copy of the qualification test for each welder so employed shall be furnished to the Owner's Representative.

D. Commissioning

1. All walk tunnels shall be cleaned of all dirt, debris, insulation, welding rods, etc. and inspected by Owner's Representative before tunnel is put in to service.

REFERENCES

1. See drawings "336347 Detail-Tunnel Structure.dwg", "336354 Detail-Steam Chase Waterproofing" and Section "336354 General Concrete Requirements – Waterproofing"