3. An expansion joint offset or bend should be placed between each two anchors.

4. Manholes should be provided at each expansion joint. Where slip joints are used manholes should be vented.

5. Branches should be taken off at or near an anchor.

6. If the distance between buildings is 150 ft. or less and the steam line contains high-pressure steam, it may be anchored in the basement of one building and allowed to expand into the basement of the second building. If the steam line contains low-pressure steam (up to 4 lb. pressure), this method may be used if buildings are 250 ft. or less apart.

7. If the distance between buildings is between 150 ft. and 300 ft. and the steam line contains high-pressure steam, the lines should be anchored midway between the buildings and allowed to expand into the basements of both buildings. If the steam line contains low-pressure steam this method may be used if buildings are between 250 ft. and 600 ft. apart. No manhole is required at the anchor, and a blind pit is all that is necessary.

8. For longer lines, manholes must be located according to judgment and depending upon the expansion value of the type of expansion joint or bend that is used. The minimum number of manholes will be required when an expansion bend or an anchor with double expansion joint is placed in each manhole and the pipes are anchored midway between manholes.

9. Stabilizers to maintain alignment of pipes should be placed on each side of each expansion joint or bend.

10. A proper hydrostatic test should be applied to the piping before the top of the conduit is applied and before application of insulation. The pressure used in this test should be greater than the pressure used in service, and should be not less than 100 lb. per square inch in any case.

11. In most types of conduit construction a drainage system is provided as a part of this construction. However, where the steam lines are laid at or near the level of sewers, or when tidal water is likely to give trouble, a separate drainage system should be installed and connected to a manhole at the lowest point and equipped with suitable pumping apparatus.

The styles and construction of conduits commonly used may be classified as follows:[1]

Filler Type: The pipes are supported on expansion rollers properly supported from the conduit or independent masonry base. The pipes are protected by a split-tile conduit, and the entire space between the pipes and the tile is filled with an insulating filler. Thus the pipes are nested and the insulation between them and the tile effectively prevents circulation of air. The conduit is placed on a bed of gravel or crushed rock from 4 to 6 in. thick, which is extended upward so as to come about 2 in. above the parting lines of the tile. A tile underdrain is placed beneath the conduit throughout the entire length and is connected to sewers or to some other point of free discharge.

Insulated Tile Type: The insulating material is molded to the inside of a split-tile conduit. The pipes are supported on expansion rollers usually. The space between the pipes and the insulating conduit lining may also be filled with an insulating filler. The conduit insulation, piping and earth load are supported by the base drain. A few inches of gravel or crushed rock are placed about the conduit and the base drain.

Sectional Insulation Type (Tile Conduit): Each pipe is insulated in the usual way with any desired type of sectional pipe insulation over which is placed a standard water-proof jacket with cemented joints. The pipes are enclosed in a split-tile conduit which is placed on a bed of crushed rock or gravel from 4 to 6 in. thick. This gravel bed is extended upward so as to come about 2 in. above the parting lines of the tile. Underdrains are sometimes omitted where this type is used; any water which seeps into the conduit being allowed to flow down the bottom of the conduit to the nearest manhole. Drains are laid from the floor of each manhole to some point of free discharge. The pipes are supported on roller frames and these, according to the type of conduit used, are either supported by the conduit itself or have their lower parts set in concrete, thus supporting the pipes independent of the conduit.

[1]For further data on pipe insulation, see Chapter 24.

Sectional Insulation Type (Tile or Concrete Trench): A type of construction frequently used in city streets, where service connections are required at frequent intervals, the pipes are insulated as described in the preceding paragraph, and are enclosed in a box or trench made either entirely of concrete, or with concrete bottom and specially constructed tile sides and tops. The pipes are supported on roller frames secured in the concrete.

Sectional Insulation Type (Bituminized Fibre Conduit): Each pipe is individually insulated and encased in a bituminized fibre conduit. The insulating material is 85 per cent carbonate of magnesia sectional pipe covering, applied in the usual manner as on overhead pipes, except that bands are omitted. After every fifth section of magnesia covering there is applied a short, hollow section of very hard asbestos material in the bottom portion of which rests a grooved-iron plate carrying ball-bearings upon which the pipe rides when expanding or contracting. This short expansion section is of the same outside diameter as the adjacent 85 per cent magnesia covering. Over the pipe covering and expansion device there are placed two layers of bituminized fibre conduit with all joints staggered and the surface of each conduit, finished with liquid cement. Conduits are placed on a bed of crushed rock or gravel, approximately 6 in. deep, and this is extended upward to about the center line of the conduit when trench is backfilled. Underdrains leading to points of free discharge are placed in the gravel or crushed rock beds.

PIPE TUNNELS

Where steam heating lines are installed in tunnels large enough to provide walking space, the pipes are supported by means of hangers or roller frames on brackets or frame racks at the side or sides of the tunnel. The pipes are insulated with sectional pipe insulation over which is placed a sewed on painted canvas jacket or a jacket of asphalt saturated asbestos water-proofing felt. The tunnel itself is usually built of concrete and water-proofed on the outside with membrane water-proofing. Tile drains are installed at each side or in the center below the level of the tunnel floor to prevent the building up of static water pressure on the outside of the construction.

On account of their relatively high first cost as compared with smaller conduits, walking tunnels are sometimes not installed where provision for the heating lines is the only consideration, but only where required to accommodate miscellaneous other services, such as for underground passage between buildings.

STEAM USED PER SQUARE FOOT OF RADIATION PER SEASON

The following factors are used in New York City for the different classes of buildings listed. The factors are based on maintaining for certain hours 70 deg. inside temperature with a minimum of 0 deg. outside and an average of 43 deg. for the heating season, eight months, October 1 to June 1. In this group are six types of buildings:

For manufacturing or commercial loft type, where steam is used to heat the premises during the day hours to maintain 65 to 68 deg. from 9 A.M. to 5 P.M. No Sunday or holiday use and no night use. *Factor:* 325 lb. per square foot of radiation per season.

For office buildings using steam during daylight hours only to maintain 70 deg. from 9 A.M. to 6 P.M. for approximately 240 days (heating season). No night use. *Factor:* 400 lb. per square foot of radiation per season.

For office buildings using steam during day hours and at night when required to 7, 8 and 9 P.M. (customary where there are stock brokers or banking offices), 204 days. *Factor:* 500 lb. per square foot of radiation per season.

For residences of the block type (not detached) where high-class heating service is required somewhat similar to apartment buildings. *Factor:* 550 lb. per square foot of radiation per season.