

Chapter H 54

WATERWORKS

- H 54.01 Plant design
- H 54.02 Operation

H 54.01 Plant design. (1) GENERAL PLANS. The general plans shall show the location of:

- (a) All wells, intakes, or other sources of supply.
- (b) The purification plant.
- (c) All mains together with their sizes and depth.
- (d) All shut-off valves, hydrants, cross connections, etc.
- (e) Storage of distribution reservoirs.

(2) DETAIL PLANS. The detail plans shall show:

(a) Details regarding intake pipe, crib, screens, etc., if water is taken from stream or lake.

(b) If a ground water supply, details of the well, spring infiltration gallery, etc., the manner of protecting the supply from surface wash and other pollution. A sketch or statement showing all possible sources of pollution within 500 feet, and the direction of the ground water flow, if known, shall also be submitted.

(c) Complete details of the purification plant including sedimentation and mixing chambers; collecting and piping systems; method of applying chemicals; filters, including depth, size and uniformity of various strata; rate controllers; loss of head gauges; washing arrangement; pumps; special devices, etc.

(d) Details of the pumping station and equipment.

(e) Any special appurtenances or fixtures in connection with the distribution system.

(f) Details of elevated tanks, stand pipes or reservoirs used for storage of the water.

(3) PROTECTION OF SOURCE. A suitable intake properly screened and located shall be provided for surface supplies. Wells, springs, etc., shall be adequately protected from all surface wash. Ground water sources shall be so located that there will be no danger of pollution from insanitary surroundings such as cesspools, privies, sewers, etc. This practically prevents the use of shallow wells or springs in a municipality or in thickly populated areas and also of deep wells if not properly sealed.

(4) PUMPING EQUIPMENT. The pumping equipment shall be divided into two or more units except where ample storage is available to permit necessary repairs without interrupting the service. The capacity shall be ample for fire protection and domestic consumption.

(5) PURIFICATION. (a) Some modern method of purification, applicable to the needs of the municipality or institution, and adaptable to the water to be treated, shall be provided in connection with all surface supplies.

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(b) Apparatus for direct, positive and accurate application of chemicals, also adequate mixing devices and sedimentation basins, shall be provided in connection with all mechanical gravity or pressure filters. In each case a careful study should be made of the character of the water and experimental work done, if necessary, to determine the type of purification or treatment adaptable.

(c) Rate controllers and loss of head gauges shall be provided for all filters. The depth of the filtering sand shall not be less than $2\frac{1}{2}$ feet, its effective size shall not be less than .2 millimeter nor more than .4 millimeter, and its uniformity coefficient should not exceed 2. Sand shall be practically pure quartz or silica free from dirt or foreign material. The following average rates of filtration shall not be exceeded:

1. Slow sand filters, 4,000,000 gallons per acre per day.
2. Gravity mechanical filters, 125,000,000 gallons per acre per day.
3. Pressure mechanical filters, 75,000,000 gallons per acre per day.

(d) Purification plants shall be divided into a sufficient number of units to allow for necessary repairs and alterations without interrupting service or impairing the quality of the water delivered.

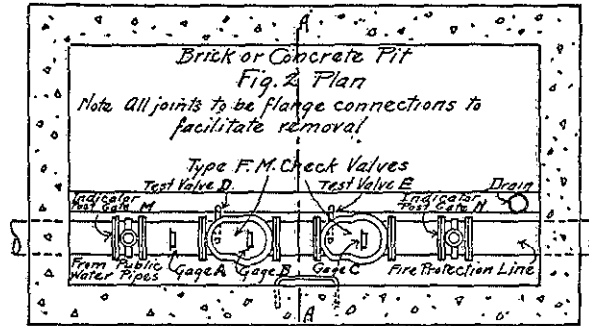
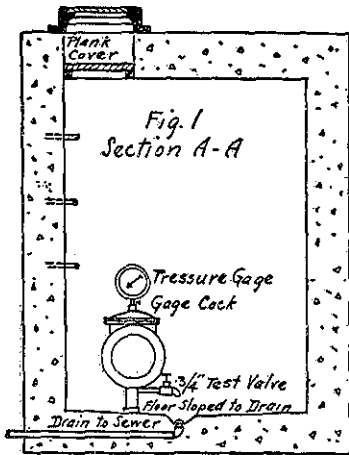
(6) **AUXILIARY INTAKES, BY-PASSES AND CROSS CONNECTIONS.** Auxiliary intakes, by-passes or cross connections whereby polluted water may be pumped or allowed to flow into the distribution system of any public supply under any conditions will be prohibited except under the following special conditions:

(a) An existing intake or by-pass may be maintained providing a section of the pipe is removed to be re-inserted only in case of emergency and immediately issuing notice to consumers to boil all water used and notifying the board by wire.

(b) In new supplies, auxiliary intakes or by-passes may be permitted by special approval of the board if satisfactory reasons are set forth as to the necessity therefor, and installation made in accordance with (a) above.

(c) An existing cross connection for fire protection purposes only which was originally installed before January, 1924 may be continued if protected by approved types of double check and gate valves equipped with suitable gauges and drains for testing, as shown in Fig. 1, and on condition that monthly inspections of such equipment are made and reported upon by the owner of the public supply on or before the tenth day of each month. The board reserves the right to require elimination of any cross connection if inspections are not regularly made and reported upon, or if the connection is found faulty. All cross connections other than those used only for fire protection purposes shall be eliminated. New cross connections are prohibited. Permission to maintain any existing cross connection for fire protection purposes must be obtained from the board on or before January 1, 1930.

(7) **DISTRIBUTION SYSTEM.** The distribution system shall be constructed of suitable material and provided with sufficient shut-off valves to facilitate operation and repairs. Where practical, dead ends shall be connected so as to provide adequate circulation of the water. Pipe smaller than 4 inches in diameter shall not be used in municipal systems except possibly for isolated service connections.



TEST TIGHTNESS of check valves and report to State Board of Health once each month as follows: (Sec. 18 Rules & Regulations, Close Valve M leaving N open with fire pressure on. Open Test Valve D. If pressure falls at Gage A and holds at B after slight decrease, Check F is tight. While Test Valve D is open and Gage A stands at zero open Test Valve E. If pressure at Gage B falls to zero and flow from E ceases, Check G is tight. If either check leaks repair at once.

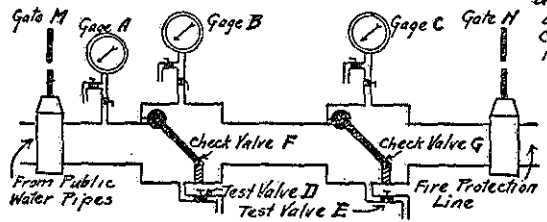


Fig. 3 Arrangement Diagram of Valves

DOUBLE CHECK VALVE INSTALLATION

BETWEEN
Public and Factory Water Supplies
Wisconsin State Board of Health
Bureau of Sanitary Engineering

Note: adapted from drawing of Associated Factory Mutual Ins. Co. Boston, Mass June 1918.

Figure 1. Double check valves for cross connections.

(8) **FIRE PROTECTION.** The pumping equipment, storage facilities, distribution system and location of hydrants shall be such as will furnish adequate fire protection.

(9) **ENGINEER'S REPORT.** The engineer's report shall cover the following:

(a) *Water consumption.* State the present and estimated population twenty-five years hence for municipalities; for institutions the present and estimated ultimate capacity. Any special conditions that might affect the growth of the municipality or institution, also any industrial activities that may affect the requirements of the water supply, should be discussed. Give estimate of the daily total and per capita consumption, both for present and future population.

(b) *The source of supply.* 1. If samples of the water can be obtained results of chemical and bacteriological analyses shall be included, otherwise the probable character of the water shall be discussed, basing conclusions on analyses or other available information regarding water from similar sources.

2. If a surface supply, the area, population and a description of the tributary watershed shall be given. All possible sources of pollution, topographical and geological features of the watershed, and other conditions that might in any way affect the quality or quantity of the supply shall be discussed in detail.

3. If the source is ground water, give details regarding the number, depth and character of the wells, springs, infiltration galleries, etc., and definite information regarding the various strata. State whether the source is ever subject to flooding.

(c) *Purification.* State reasons for adopting the method of purification outlined, specifying any experimental work done. Describe completely any special appliances.

(d) *Pumping equipment.* The number, type, size and capacity of the pumps to be installed and type of power should be given; discuss clearly any special features and method of connecting the pumps with the wells, suction lines or other parts of the system.

(e) *Distribution system.* State the class, weight and amount of the various sizes of pipe and describe any special features.

(f) *Storage.* Give amount and location of the storage available, both before and after purification, together with details regarding its effect upon the quality of the supply.

(g) *Fire protection.* Discuss adequacy of fire protection in regard to capacity and pressure.

(h) *Cost.* Give estimated cost of integral parts of the system, both for complete design and original installation.

summary to be added
 H 54.02 **Operation.** (1) **DISTRIBUTION SYSTEM.** All intakes, pumping equipment and distribution systems shall be maintained in a proper operating condition at all times. The mains shall be regularly flushed at sufficiently frequent intervals to prevent accumulation of sediment or of stagnant water.

(2) **SEDIMENTATION AND STORAGE RESERVOIRS.** All sedimentation and storage reservoirs shall be cleaned at sufficiently frequent intervals to prevent such accumulation of sediment as will interfere with the efficient operation of the waterworks.

(3) **SLOW SAND FILTERS.** Slow sand filters shall be cleaned at such times as may be necessary to secure efficient operation. In general the "loss of head" should not exceed 5 feet before cleaning. When sand has been removed from the filter so that the remaining depth is less than 1½ feet, the filter bed shall be brought up to its original depth by adding clean sand of a proper size and grade.

(4) **MECHANICAL FILTERS.** (a) In connection with all mechanical filters, the water shall receive preliminary treatment consisting of coagulation and sedimentation. A sufficient amount of the coagulant shall be applied at all times to secure a satisfactory flow. Before the "loss of head" has reached 10 feet, the filters shall be washed with filtered water until the effluent wash water is practically clear. Subsequent to washing the first filtrate shall be wasted for a sufficient period of time to place the plant again in effective operating condition. Sudden changes in the rate of filtration shall be avoided.

(b) Care must be exercised to prevent caking or cementing of the sand in the filter beds and should this occur the sand shall be removed and replaced by new sand or the old sand may be screened and returned to the beds. When the depth of the sand in the filter becomes less than 2 feet because of loss by washing, the filter shall be brought to its original depth by adding new sand of a proper size and quality.

(5) **STERILIZATION.** Where any process of sterilization is used as a method of purification, the plant shall be so operated as to secure effective results at all times. Extra parts or duplicate apparatus shall be kept on hand to avoid unnecessary delays.