Designation: D 4188 – 82 (Reapproved 2003)

Standard Practice for Performing Pressure In-Line Coagulation-Flocculation-Filtration Test [1]

This standard is issued under the fixed designation D 4188; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers the procedure used to perform pressure in-line coagulation-flocculation-filtration of water and waste water. It is applicable to water and waste water with relatively low suspended solids (<30 mg/L). The practice is applicable for any size filter greater than 100 mm (4 in.) in diameter.

1.2 This practice can be used to determine the effectiveness of flocculants or coagulants, or both, and filter medium(a) in removing suspended and colloidal material from water and waste water.

1.3 Interval between filter backwashing, backwash requirements, rinse requirements, and effect of filtration rate on effluent quality can also be obtained with this practice.

1.4 *This standard does not purport to address all of the safety concerns, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *ASTM Standards:* [2]

D 1129 Terminology Relating to Water

D 1888 Test Methods for Particulate and Dissolved Matter, Solids, or Residue in Water[3]

D 1889 Test Method for Turbidity of Water

D 2035 Practice for Coagulation-Flocculation Jar Test of Water

D 3370 Practices for Sampling Water from Closed Conduits

D 4187 Test Methods for Zeta Potential of Colloids in Water and Waste Water[3]

D 4189 Test Method for Silt Density Index (SDI) of Water

3. Terminology

3.1 *Definitions:* For definitions of terms used in this practice, refer to Definitions D 1129.

4. Summary of Practice

4.1 A flocculant or coagulant, or both, is added to a pressurized flowing water or waste water stream, and the floc that forms is removed, using a filter medium(a).

4.2 The effectiveness of the system in removing suspended and colloidal matter is determined by monitoring the quality of the filter effluent.

4.3 A holding tank for floc formation or floc growth is optional.

4.4 The practice also provides information on interval between filter backwashing, backwash requirements, rinse requirements and effect of filtration rate on effluent quality.

5. Significance and Use

5.1 Pressure in-line coagulation-flocculation followed by filtration is an effective process to remove suspended and colloidal matter from water and waste water.

5.2 The effectiveness of this process is dependent on the type and concentration of the flocculant or coagulant, or both, the pH, the temperature, the filtration medium(a), and the filtration rate. This practice permits the evaluation of these various parameters.

5.3 This practice can also be used to determine filter backwash and rinse requirements.

5.4 The results obtained from this practice can be used for plant design of large systems.

6. Apparatus

6.1 *Installation*:

6.1.1 To prevent contamination by corrosion products, use stainless steel, plastic, or coated (rubber or epoxy-lined) steel for all wetted parts.

[1] This practice is under the jurisdiction of ASTM Committee D19 on Water and is the direct responsibility of Subcommittee D19.03 on Sampling of Water and Water-Formed Deposits, Analysis of Water for Power Generation and Process Use, On-Line Water Analysis, and Surveillance of Water.

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[2] For referenced ASTM standards, visit the ASTM website, www.astm.org, or contact ASTM Customer Service at service@astm.org. For *Annual Book of ASTM Standards* volume information, refer to the standard's Document Summary page on the ASTM website.

[3] Withdrawn.

6.1.2 Take care to ensure that no contamination will occur from oil films on new metal piping, release agents on raw plastic components, or from solutions previously used in the system. Thoroughly clean or degrease, or both, any materials that are suspect.

6.1.3 Design all pressurized components based on the manufacturer's working pressure rating. Review the manufacturer's rating for compliance with standard engineering practice.

6.1.4 Assemble the system as shown in Fig. 1. The holding tank just preceding the filter is optional. Use a manual flow control valve to regulate the filter effluent flow.

NOTE 1—Since the filter is intended to be operated at constant flow with differential pressure changes across the filter, manual flow adjustments may be required periodically. For streams that yield a high filter loading rate, an automatic flow control valve might be required.

NOTE 2—If a holding tank is used, it should be designed to obtain uniform flow to minimize stagnant zones and to keep the floc suspended. It should also be sized to obtain the desired retention and contain an air vent.

6.1.5 Operate the apparatus by drawing water from the water supply and pumping it through the system under pressure. Use a gage pressure of 275 to 345 kPa (40 to 50 psi) as the filter inlet pressure.

NOTE 3—If the water supply is already sufficiently pressurized, the pressurizing centrifugal pump is not required.

6.1.6 Use a single calibrated pressure gage equipped with a" quick-connect" fitting to measure the filter inlet pressure and filter pressure drop. Individual gages are also satisfactory but not as reliable as a single "quick-connect" pressure gauge.

6.1.7 Use either a flowmeter or a calibrated volume container and stopwatch to measure the filter effluent flow.

6.1.8 Use an accurate metering pump to inject the flocculant or coagulant, or both. Use an injector with a check valve and locate the teat of the injector in the center of the flowing stream and in the vertical position.

6.1.9 Use a calibrated volume container and stopwatch to measure the injection pump rate.

NOTE 4—If the suction line of the metering pump is placed into the volume container, it is necessary to subtract the volume displaced by the suction line.

6.1.10 With small inside diameter piping (½-in. nominal), use five or six right-angle elbows for mixing. With large inside diameter piping, use in-line static mixing to obtain good mixing.

6.1.11 Valve the filter so the raw water supply can be used for backwashing.

6.1.12 To protect the pump, install a flow-sensor switch to shut the system down if the water supply to the pump is interrupted.

NOTE 5—If a centrifugal pump is used, excessive pressure is usually no problem provided the pump or piping or both are properly sized. Either a high-pressure limit control switch or a pressure-relief device can be installed after the pump, if there are any doubts about excessive pressure.

6.1.13 If the system pressure fluctuates by more than ± 35 kPa (±5 psi), install a pressure regulator immediately downstream of the pressure control valve.

6.2 To minimize wall effects, use a filter with a minimum diameter of 100 mm (4 in.).

7. Reagents

7.1 For a list of typical coagulants and the preparation of polyelectrolyte solutions, refer to Practice D 2035.

8. Procedure

8.1 *Start-Up Procedure*:

8.1.1 First, backwash the filter with the supply water to thoroughly clean the filter medium. Use the backwash rate recommended by the filter medium supplier, which is usually 20 to 50 $m^3/(h \cdot m^2)$ of filter area (8 to 20 $gal/(min \cdot ft^2)$). Backwash the filter until the turbidity (as determined by Test Method D 1889) of the backwash is equal (within 10 %) to the

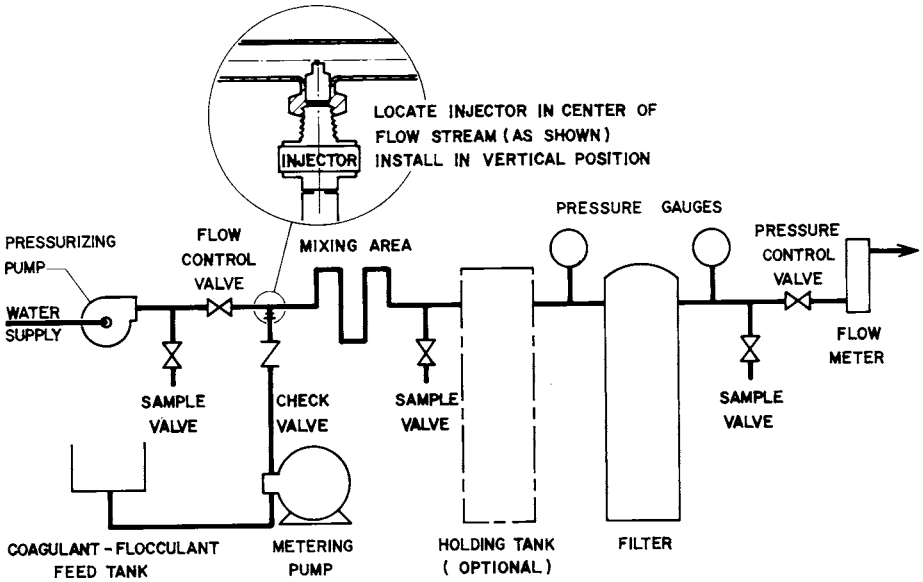

FIG. 1 Typical Pressure In-Line Coagulation-Flocculation Filtration System