# Silt Density Index Standard Test Method

## Scope

This test method covers the determination of the silt density index (SDI) of water. This test method can be used to indicate the quantity of particulate matter in water and is applicable to relatively low (<1.0 FTU) turbidity waters such as well water, filtered water, or clarified effluent samples. Since the size, shape, and nature of particulate matter in water may vary, this test method is not an absolute measurement of the quantity of particulate matter.

This test method is not applicable for reagent grade water Types I, II and II of Specification D1193, or effluents from most reverse osmosis and ultra-filtration systems.

This standard may involve hazardous materials, operations and equipment. This standard does not purport to address all of the safety problems 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.

## Referenced Documents

ASTM Standards
D 1229 Definitions of Terms Relating to Water
S 1193 Specification for Reagent Water
D 3370 Practices for Sampling Water
E 1 Specification for ASTM Thermometers

## Terminology

Definitions - For definitions of terms used in this test method, refer to Definitions D 1129
Descriptions of Term Specific to This Standard Silt Density Index (SDI) - An index calculated from the rate of plugging of a 0.45 µm membrane filter.

## Summary of Test Method

Water is passed through a 0.45 µm membrane filter at a constant applied gauge pressure of 207 kPa (30 psig), and the rate of plugging of the filter is measured.
The SDI is calculated from the rate of plugging.

## Significance & Use

1. The SDI can serve as a useful indication of the quantity of particulate matter in water.
2. The SDI can be used to determine effectiveness of various processes such as filtration of clarification used to remove particulate matter.
3. The SDI has been empirically correlated with the fouling tendency of some water treatment equipment such as reverse osmosis devices.
4. The SDI may vary as a function of water temperature and values obtained at different temperatures may not necessarily be comparable.
5. The SDI will vary with the membrane filter manufacturer. Thus, SDI values obtained with filters from different membrane manufacturers, cannot be comparable.

## Apparatus

1. SDI Assembly, as schematically described in Fig. 1. All wetted parts should be made of high quality stainless steel or plastic to prevent contamination by corrosion produced. Do not use reactive materials such as carbon steel or iron. Suitable filter holders, designed to withstand an operating gauge pressure of 350 kPa (50 psig) can be obtained from suppliers of membrane filters.
2. Membrane filter, 47 mm in diameter, gridded, with a mean pore size in the range of 0.45 ± 0.02 µm. Use only filters that are packaged in the same orientation.
3. Graduated cylinder, 500-ml capacity.
4. Stopwatch, graduated in hundredths of a minute.
5. Thermometer, liquid-in-glass, suitable for measuring the temperature of the water sample; capable of being read within ± 1ºC and conforming to the requirements as described in specification E1.

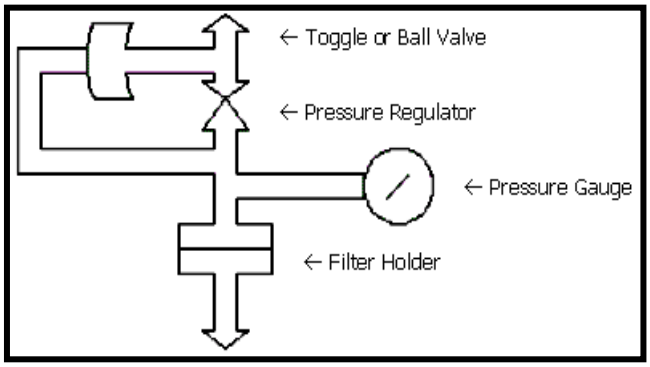


Fig. 1: Apparatus for Measuring the Silt Density Index

## Procedure

Assemble the apparatus as shown in Fig. 1 and set pressure regulator at 207 kPa (30 psig).
Before installing the membrane filter, flush the water to be tested through the apparatus to remove entry contaminants. For sampling, follow the procedure given in practices D 3370. Discrete samples can be used with appropriate pressurizing apparatus such as a booster pump to obtain a feed supply gauge pressure of > 276 kPa (>40 psig).

Measure the temperature of the water.

Open the membrane filter holder and place a 0.45 µ membrane filter (47mm in diameter) on the holder. Place the filter grid side up. Handle the membrane filter only with dull tweezers to avoid puncture. Avoid touching the membrane filter with the fingers.

Note 1: Other membrane filter sizes, that is, 25 mm or 90 mm diameter can be used.

Note 2: Record the manufacturer of the membrane filter and the manufacturer's identification for the membrane filter.
Make sure the o-ring is in good condition and properly placed. Replace the top half of the filter holder and close loosely.
Bleed out trapped air y cracking the ball valve. Close the valve and tighten the filter holder.
Open the ball valve. Simultaneously, using a stopwatch, begin measuring the time required for the flow of 500 mL. Record the time ($t_i$). Leave the valve open for continued flow.

Note 3: Time ($t_i$) to collect 500 mL should be within ± 10% of the time to collect 500 mL using non-plugging reference water at the same water temperature. The non-plugging reference water can be obtained by filtering distilled water through a 0.2 µm pore size membrane filter.

Note 4: If it is less than 90% of the non-plugging time, the filter may be cracked and new filter should be used. If it is more than 110% of the non-plugging time, then a smaller sample size, that is 250 mL or 100 mL should be used.

Note 5: The 500 mL sample size is based on a 47 mm diameter filter. If a different filter size is used, adjust the sample size in direct proportion to the filter area.

Measure and record the times to collect additional 500 mL (Note 6) volumes of sample, starting the collectoin at 5, 10 and 15 min of total elapsed flow time. Measure the water temperature and check the pressure as each sample is collected (Notes 7 & 8).

Note 6: If the initial size was not 500 mL, sue the same sample size as previously used.

Note 7: The pressure must remain at 207 ± 7 kPa (30 ±1 psig) through the test.

Note 8: The water temperature must remain constant (± 1ºC) throughout the test. This is necessary as flow rate changes by about 3% per ºC.

After Completion of the test, the membrane filter may be retained for future reference.

## Calculation

Calculated the Silt Density Index (SDIT) as follows:

$$SDIT = (\%P30 \div T) = [1-(t_i \div t_f)] \bullet 100 / T$$

Where:

%P30= percent at 207 kPa (30 psig) feed pressure
T = total elapsed flow time, min (usually 15 min, see Note 9)
$t_i$ = initial time required to collect 500 mL of sample (s)
$t_f$ = time required to collect 500 mL of sample after test time T (usually 15 min, see Note 9)

Note 9: For this test method, %P30 should not exceed 75%. If %P30 exceeds this value, use a shorter time for T, that is, 5 or 10-min measurements. If %P30 exceeds 75% after 5 min, other test methods should be used to analyze for particulate matter.

## Report

Report the following information:

1. The SDI, with a subscript indicating the total elapsed flow time (T) in minutes.
2. The water temperature before and after the test, and
3. The manufacturer of the 0.45 ±m membrane filter used for the test, as well as the manufacturer's identification for the membrane filter.

## Precision & Bias

Based on round-robin testing, the pooled single operator standard deviation of this test method is 0.43 for water sources of choice with a silt density index (SDI) of 0.4 to 15. Nine operators from five laboratories participated using the test water of their choice.

The bias of this test method cannot be determined because the test method is based upon waters of choice, which may differ with each source.

It is the user's responsibility to ensure the validity of this test method for waters of untested matrices.