



Standard Practice for Calculation and Adjustment of the Stiff and Davis Stability Index for Reverse Osmosis¹

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1. Scope

1.1 This practice covers the calculation and adjustment of the Stiff and Davis Stability Index (S & DSI) for the concentrate stream of a reverse osmosis device. This index is used to determine the need for calcium carbonate scale control in the operation and design of reverse osmosis installations. This practice is applicable for concentrate streams containing more than 10 000 mg/L of total dissolved solids. For concentrate streams containing less than 10 000 mg/L of total dissolved solids, refer to Practice D3739.

1.2 *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

- D511 Test Methods for Calcium and Magnesium In Water
- D1067 Test Methods for Acidity or Alkalinity of Water
- D1129 Terminology Relating to Water
- D1293 Test Methods for pH of Water
- D1888 Methods Of Test for Particulate and Dissolved Matter in Water (Withdrawn 1989)³
- D3739 Practice for Calculation and Adjustment of the Langelier Saturation Index for Reverse Osmosis
- D4194 Test Methods for Operating Characteristics of Reverse Osmosis and Nanofiltration Devices
- D4195 Guide for Water Analysis for Reverse Osmosis and Nanofiltration Application

¹ This practice is under the jurisdiction of ASTM Committee D19 on Water and is the direct responsibility of Subcommittee D19.08 on Membranes and Ion Exchange Materials.

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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 The last approved version of this historical standard is referenced on www.astm.org.

D6161 Terminology Used for Microfiltration, Ultrafiltration, Nanofiltration and Reverse Osmosis Membrane Processes

3. Terminology

3.1 *Definitions*—For definitions of terms used in the practice, refer to Terminology D1129 and D6161.

3.2 Definitions of Terms Specific to This Standard:

3.2.1 For description of terms relating to reverse osmosis, refer to Test Methods D4194.

3.2.2 *Stiff and Davis Stability Index (S & DSI)*⁴—an index calculated from total dissolved solids, calcium concentration, total alkalinity, pH, and solution temperature that shows the tendency of a water solution to precipitate or dissolve calcium carbonate.

4. Summary of Practice

4.1 This practice consists of calculating the S & DSI index for a reverse osmosis concentrate stream from the total dissolved solids, calcium ion content, total alkalinity, pH, and temperature of the feed solution and the recovery of the reverse osmosis system.

4.2 This practice also presents techniques to lower the S & DSI by decreasing the recovery; decreasing the calcium and alkalinity concentrations; or by changing the ratio of total alkalinity to free carbon dioxide in the feedwater.

5. Significance and Use

5.1 In the design and operation of reverse osmosis installations, it is important to predict the calcium carbonate scaling properties of the concentrate stream. Because of the increase in total dissolved solids in the concentrate stream and the differences in salt passages for calcium ion, bicarbonate ion, and free CO₂, the calcium carbonate scaling properties of the concentrate stream will generally be quite different from those of the feed solution. This practice permits the calculation of the S & DSI for the concentrate stream from the feed water analyses and the reverse osmosis operating parameters.

⁴ Stiff, H. A. and Davis, L. E., "A Method for Predicting the Tendency of Oil Field Waters to Deposit Calcium Carbonate," *Petroleum Transactions*, Vol 195, 1952.