

## 9-1. Performance Warranty

Woongjin Chemical Industries, Inc. guarantees the performance of its reverse osmosis elements only when the elements are used in the system operated under the following conditions.

### 1. Conditions for Handling CSM Elements in general.

Keep elements moist at all times after initial wetting

Permeate water obtained from first hour of operation should be discarded.

CSM elements should be immersed in a protective solution during storage, shipping or system shutdowns to prevent biological growth and freeze damage. The standard storage solution contains 18-20 weight percent propylene glycol and 1 weight percent sodium metabisulfite (food grade). For short term storage of one week, a 1 weight percent sodium metabisulfite solution is adequate for inhibiting biological growth.

Elements must be in use for at least six hours before formaldehyde is used as a biocide. The elements exposed to formaldehyde before being in use for six hours may lose flux.

The customer is fully responsible for the effects of incompatible chemicals on elements. Their use will void the element limited warranty.

### 2. Conditions for System Design and Equipment

The system array, recovery and instrumentation and the design parameters and components of the system in which the element(s) are employed shall be consistent with sound engineering practice. Woongjin Chemical reserves the right to review system design.

Recovery ratio shall be consistent with concentration of sparingly soluble salts.

There shall be no membrane scaling caused by failure of the chemical dosing system (e.g., Ca, Ba, or Sr salts)

Adequate provisions against microbiological contamination shall be incorporated into the system design, as well as into all operating and maintenance procedures.

### 3. Conditions for Feed Water

Feed water SDI (15 min., 30 psi) shall be less than 5.0.

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Feed water shall contain no colloidal sulphur.

There shall be no membrane fouling by colloidal or precipitated solids.

The brine-soluble silica shall be less than 150mg/L at 25°C.

### 4. Conditions for Operating Parameters

The element(s) shall not be exposed to pressure greater than 1000 psi for seawater elements, 600 psi for brackish water elements, and 300 psi for tap water elements.

Back-pressure (where permeate static pressure exceeds reject static pressure) shall not exceed 5 psi at any time.

The element(s) shall be operationally protected against hydraulic shock loading (water hammer).

Feed water temperature shall be less than 45°C.

### 5. Conditions for Chemicals on Elements

Antiscalants used shall be standard or approved equivalent.

During continuous operation the pH shall be no less than 2.0 nor greater than 11.0. If pH adjustment is required, use H<sub>2</sub>SO<sub>4</sub> or approved equivalent.

There shall be no membrane damage caused by chemical compounds (e.g., surfactants, solvents, soluble oils, free oils, lipids, and high molecular weight natural polymers.)

Feed water shall contain no ozone, permanganate, chlorine or other strong oxidizing agents.

Neither nonionic and cationic surfactants, nor any other chemical not approved by Woongjin

Chemical should be used for membrane cleaning or shall come in contact with elements.

### 6. Conditions for Cleaning Elements

Cleaning shall be initiated at 10% to 15% normalized product flow decline.

The element(s) shall not be exposed during cleaning, or in shutdown periods, to a pH less than 2 or greater than 12.

Cleaning chemicals used shall be standard or approved equivalent.