FilmTec™ Membranes

DuPont Food Processing and Sanitary Element Cleaning Guide

The following are general recommendations for cleaning DuPont™ full-fit and sanitary design spiral elements used in food, dairy, and other consumables process streams. More detailed procedures for cleaning a membrane system are typically included in the operating manual provided by the system supplier or from a contracted cleaning chemical supplier.

The recommendations included in this guide are not intended for use for cleaning membranes which may be used in water purification. Do not use this cleaning guide for water purification membranes.

Introduction

The surface of a membrane is subject to fouling by foreign materials which may be present in the feed stream such as hydrates of metal oxides, calcium precipitates, organics and biological matter. The term "fouling" includes the build-up of any type of material on the membrane surface, including mineral scaling.

Membrane surface fouling manifests itself in a performance decline; lower permeate flow rate and/or higher solute passage. Increased pressure drop between the feed and concentrate may be a side effect of fouling.

Cleaning can be accomplished very effectively because of the combination of pH stability and temperature resistance of DuPont membranes.

It is assumed for food and dairy streams that cleaning may be required daily for DuPont membranes.

Safety Precautions

1. When using any chemicals indicated in subsequent sections, follow accepted safety practices. Always wear eye protection as a minimum. In the case of handling corrosive chemicals (e.g., sulfuric acid), wear full face cover and protective clothing. Consult the chemical manufacturer for detailed information about safety, handling and disposal.
2. When preparing cleaning solutions, ensure that all chemicals are dissolved and well mixed before circulating the solutions to the elements.
3. High-quality water must be used for flushing, cleaning and disinfecting DuPont membranes. This water must be chlorine-free for reverse osmosis (RO) and nanofiltration (NF) systems. Seewater Quality section in this Product Information bulletin for specific requirements.
4. Cleaning chemicals will be present on both the permeate and retentate sides of the membrane immediately after cleaning. Care should be taken to properly flush residuals from the system prior to operation with the feed stream.
5. During recirculation of cleaning, disinfecting and flushing solutions, the temperature and pH must not exceed the guidelines for the specific membrane type. See additional guidelines in this Product Information bulletin.

Cleaning Method

The cleaning method described below is known as cleaning in place (CIP). This means the cleaning is performed in very much the same way as ordinary production; however, it is done with proper adjustment of the operating parameters, temperature and pressure. The cleaning procedure is more effective when performed at an elevated temperature. Typically, cleaning is conducted between 45- 50°C and chemical disinfection is at or below 25°C. Dosing of the cleaning chemicals and operation of the cleaning procedure can be performed manually or automatically, depending on the specific design requirements.

In general, the cleaning regimen will include the following steps. Note that between each step in the cleaning procedure, the system must be flushed with high-quality water.

Form No. 45-D01865-en, Rev 2
June 2025

- Purge feed stream from the system
- Flush with water
- Clean in one or more steps, according to the selected procedure
- Flush with water
- Disinfection when required
- Flush with water after disinfection

Please refer to Table 1 for cleaning guidelines for FilmTec™ RO and NF Elements.

Table 1. Cleaning Parameters

Cleaning, maximum 2 hours/day*:	
Pressure range	1 - 5 bar (15 - 75 psi)
NaOH %, typical	0.05 - 0.1%
Na-EDTA %, typical	0.2 - 0.3%
Strong acid (e.g., H3PO4, or HCl) %, typical**	0.1 - 0.2%

Disinfection, short-term, when required:	
Pressure range	1 - 5 bar (15 - 75 psi)
Maximum temperature	25°C (77°F)
Free chlorine	Non-detectable
Hydrogen peroxide/peroxyacetic acid blends @ 25°C	1,000 ppm

Note: Please check with chemical supplier for concentrations of formulated cleaning agents.
* Each cleaning step is approximately 30-45 min @ 45-50°C
** Straight nitric acid is not recommended with NF membranes.

Limits for pH Range and Temperature during Cleaning

Element type	Max Temp 50°C (122°F) pH range	45°C (113°F) pH range
RO	1.8-11	1.8-11.2
NF	1.8-11	1.8-11.2

Typical cleaning step of 30 -45min
Buffering, rapid response sensors and other measures may be needed to properly manage pH at min and max limits
11.5 pH at 45°C may be used for heavily fouled membranes, but is not recommended for daily use

Water Quality

Water is the most important cleaning agent and the one used in the largest quantities. Consequently, the quality of the water used for CIP is of the utmost importance in order to avoid unwanted deposits on the membranes originating from the water.

RO quality water is recommended for flushing, cleaning and disinfecting of FilmTec™ Membranes, but prefiltered water may be used. Especially important in the CIP water is the content of sparingly soluble components such as iron, manganese and silicates. It is also important that CIP water meets a good bacteriological standard.

To ensure that water quality meets the recommendations in Table 2, CIP water quality should be monitored regularly and a complete water analysis should be made every three to six months.

Table 2. CIP water recommendations

Iron content (Fe)	< 0.05 ppm
Manganese content (Mn)	< 0.02 ppm
Aluminum content (Al)	< 0.05 ppm
Silicate content (SiO2)	< 5 ppm
Hardness†	< 85 ppm as CaCO3
Chlorine	0 ppm
Particle size	< 10 microns
Turbidity	< 0.5 NTU
Silt density	< 1 SDI
Total plate count	< 1,000 per ml
Coli form bacteria	< 1 per 100 ml

† Though soft water is recommended, in some areas cleaning chemicals are specially formulated for hard CIP water. Please check with your chemical supplier if using hard water for cleaning.

Multi-Step Cleaning

Most applications require several independent cleaning steps – for example, an alkali cleaning containing detergents succeeded by an acid cleaning (or vice versa). In such cases it is recommended NOT to mix chemicals from one step with residual chemicals in the system from the preceding step. Each cleaning step has to be followed by water flushing to remove impurities and used chemicals before new chemicals are put into the system.

Checking Cleaning Effectiveness

One common means of checking the effectiveness of the cleaning procedure is to measure the water permeate flow after cleaning. The water flux results may be an indication of whether surface foulants have been adequately removed or if an additional cleaning step should be considered.

When the cleaning procedure has been completed and before operation with product is resumed, the water permeate flow should be measured at standard operating parameters. The temperature of the water and feed pressure should be noted. By tracking and generating a history of the water permeate flux, a system operator may be alerted to a cleaning or operating upset.

Disinfection

Where high-grade bacteriological conditions are required (as in many food and dairy plants), cleaning is followed by disinfection. Frequency of disinfection will be based on plant need, feed quality and membrane type. When performing a chemical disinfection, the procedure is similar to the cleaning procedure (i.e., dosing and circulation of the solution followed by water flush). It is important that chemical disinfection using peroxide be done only at or below 25°C and in acidic conditions. Also, care should be taken to have removed the presence of iron from the membrane surface and/or disinfection water prior to disinfecting with chemical disinfectants.

Cleaning Precautions

Field experience has demonstrated that certain chemicals and cleaning conditions may have an adverse effect on membrane performance. We recommend caution with the following:

- Frequent disinfection with an oxidizing solution (such as a hydrogen peroxide blend) more than 1-2 times per week may cause premature membrane oxidation.
- Straight nitric acid solutions may have an oxidizing effect on polypiperazine membranes (such as NF). Phosphoric acid – nitric acid blends are recommended over straight nitric acid. Hydrochloric acid is the preferred acid for membrane cleaning.
- Aggressive alkaline cleanings at high temperature and pH may cause membrane degradation and lead to premature failure. We recommend cleaning within the conditions specified in this bulletin.

Preservative & Storage

Enzymatic cleaning may be used as a step in a cleaning regime (typical pH 9-10. Please check for compatibility with DuPont products prior to use.

Please consult with your membrane or chemical supplier for specific recommendations. If the system, after cleaning, will remain shut down for more than 24 hours, the membranes should be stored in a preservative solution. This is also true if membrane elements are removed from the system for storage or shipment.

When storing elements, a 1.0 weight percent sodium metabisulfite (food grade solution is adequate for the inhibition of biological growth. Ensure that the system is air tight and that all piping is closed so the system remains full.

The system should be checked on a regular basis to ensure that the system is full of the storage solution and samples taken and analyzed for bisulfite concentration. If the solution becomes discolored or if the bisulfite concentration drops, the storage solution should be replaced.

Before operating the system after storage, the storage solution should be flushed from the membranes, and a full cleaning cycle should be run. Many operators also sanitize prior to operation.

While this solution is known to not adversely affect the performance of DuPont™ membranes, other storage solutions may also be used. Please consult your chemical supplier for recommendations.

Have a question? Contact us at:
www.dupont.com/water/contact-us

All information set forth herein is for informational purposes only. This information is general information and may differ from that based on actual conditions. Customer is responsible for determining whether products and the information in this document are appropriate for Customer's use and for ensuring that Customer's workplace and disposal practices are in compliance with applicable laws and other government enactments. The product shown in this literature may not be available for sale and/or available in all geographies where DuPont is represented. The claims made may not have been approved for use in all countries. Please note that physical properties may vary depending on certain conditions and while operating conditions stated in this document are intended to lengthen product lifespan and/or improve product performance, it will ultimately depend on actual circumstances and is in no event a guarantee of achieving any specific results. DUPONT ASSUMES NO OBLIGATION OR LIABILITY FOR THE INFORMATION IN THIS DOCUMENT. References to "DuPont" or the "Company" mean the DuPont legal entity selling the products to Customer unless otherwise expressly noted. NO WARRANTIES ARE GIVEN; ALL IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE ARE EXPRESSLY EXCLUDED. No freedom from infringement of any patent or trademark owned by DuPont or others is to be inferred.
DuPont™, the DuPont Oval Logo, and all trademarks and service marks denoted with ™, SM or ® are owned by affiliates of DuPont de Nemours, Inc. unless otherwise noted. © 2025 DuPont. All right reserved

Form No. 45-D01865-en, Rev 2
June 2025