



# Tonka Ultrafiltration

## Operational Description

### Process Operation

Basic operating conditions for Tonka Ultrafiltration Systems using DOW Ultrafiltration modules are shown in Table 1 below. The process operating parameters for the cleaning steps is provided in the cleaning section.

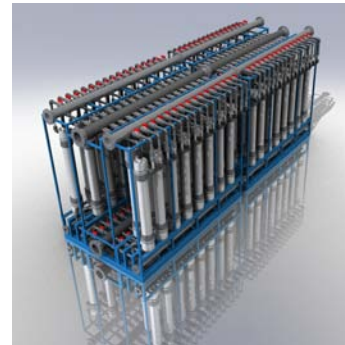
Table 1 – Normal Operating Conditions

<i>Dow Module Operating Range</i>	SI	US
Upper Feed Inlet Pressure at 40 °C	3.0 Bar	45 psi
Operating TMP (Upper Limit)	2.1 Bar	30 psi
Filtrate Flux @25C	40 - 120 L/m <sup>2</sup> /hr	24 - 70 gfd
Temperature Range (UPVC Housing Limit)	1 – 40 °C	34 - 104 °F
Operating pH Range	2 - 11	

### Normal Operation

**Normal operation** refers to the routine operating sequence of Tonka Ultrafiltration systems includes the operating (in-service filtration) and backwash steps. When the water system demands Tonka initiate the ultrafiltration system operation, the system runs for a short period in a “**forward flush**” to remove trace chemical or air residuals within the system train. The **forward flush** rinses the outside of the fibers and does not produce filtered water. After the **forward flush** is discontinued the modules can be placed in the **operating mode**. An operating cycle typically ranges from 20 to 60 minutes. While operating, 100% of the feed water is converted to permeate. As contaminants are removed during the operating step the transmembrane pressure will rise. At the end of the preset operating cycle time, a backwash sequence is triggered.

Tonka Ultrafiltration Systems



Custom Train Over 1 MGD

Normal Operation

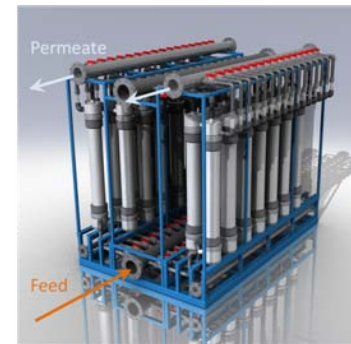
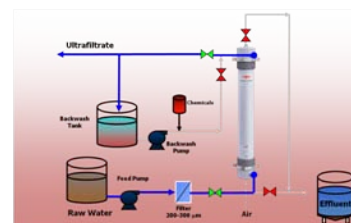


Diagram – Normal Operation





# Tonka Ultrafiltration

## Backwash

The **backwash mode** occurs automatically and may include an air scour, but always includes draining, backwash through the top drain, backwash through the bottom drain, and a forward flush. The **air scour** step, when included, is used to loosen particulates deposited on the outside of the membrane surface. Air is introduced on the outside of the

### Backwash Sequence

- Air Scour/Drain
- Backwash Top
- Backwash Bottom
- Forward Flush

#### 1. Air Scour / Drain Step

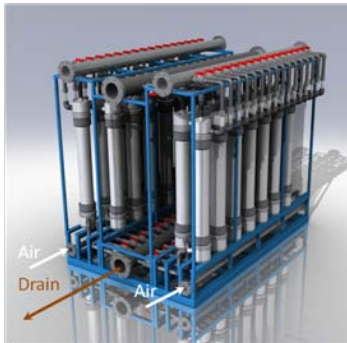


Diagram – Air Scour

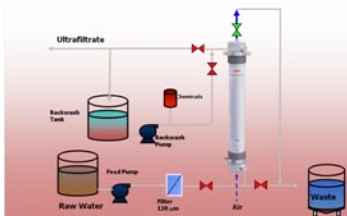
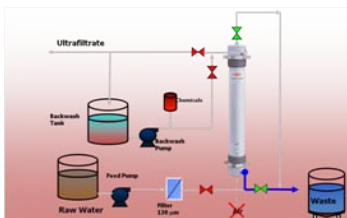


Diagram – Drain



fibers. Displaced feed flow and concentrate are allowed to discharge through the top of the module for disposal. After the air scour has been on for a short period, the module **drains** by gravity to remove dislodged particulates.

After draining, the **first backwash** step is performed. Permeate flow is reversed from the inside of the fiber to the outside and backwash flow is removed from the module housing through the top drain on the module. A top draining backwash is performed first. The **second backwash** step is performed to remove contaminants through the bottom of the module housing. Permeate flow is reversed from the inside of the fiber to the outside and backwash flow is removed from the module housing through the bottom drain on the module for efficient removal of heavier

#### 2. Backwash Top

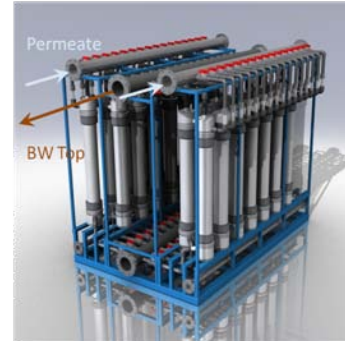


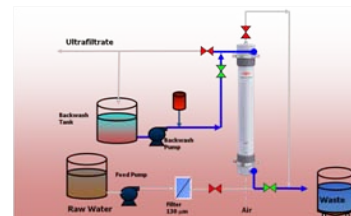
Diagram – Backwash Top



#### 3. Backwash – Bottom



Diagram – Backwash Bottom





# Tonka Ultrafiltration

materials. After backwash is complete, a **forward flush** is performed to remove any remaining contaminants and remove any air trapped on the outside of the fibers. After a backwash, the modules are returned to the **operating** mode.

## Chemically Enhanced Backwash

**CEB** operation refers to a chemically enhanced backwash.

The frequency of a CEB is dependant on the feed water quality. The CEB is performed using UF permeate blended with chemicals selected to effectively clean contaminants from the membrane surface. The choice of chemicals is based on experience or pilot test results.

The CEB follows the steps of a normal **backwash** except that a CEB chemical is dosed into the backwash water and a soak step is added after the second backwash step.

## Clean in Place Procedures

A clean in place (**CIP**) operation includes backwash and chemical recycle to clean the fibers. The CIP is performed on an “as needed” operation. The frequency of a CIP is dependent on the feed water quality and typically ranges from 1 to 3 months. Prior to a CIP the routine **backwash** steps including air scour, draining, backwash through the top drain and backwash through the bottom drain are performed. After completing the backwash steps, the module is **drained**

Pilot Units or Full Capability  
Small Systems under 50 gpm  
Available on Demand



10 gpm – 20 gpm

by gravity to remove excess water and prevent dilution of the CIP chemicals. CIP chemicals are **recycled** on the outside of the module through the chemical cleaning tank. A small chemical permeate stream will also be collected and recycled to the chemical cleaning tank. Note that the CIP solution can be heated improve its effectiveness at removing contaminants from the membrane. A **soak** follows the initial recycle step. After the soak step, CIP chemicals are again **recycled** on the outside of the module. When the recycle is completed, an air scour is performed and then the module is **drained** to remove the chemicals.

Diagram – CEB Top

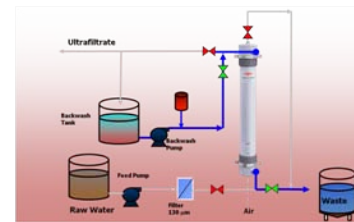


Diagram – CEB Bottom

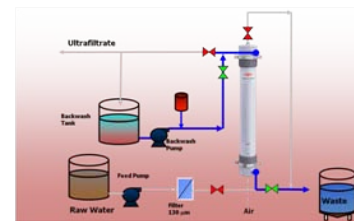
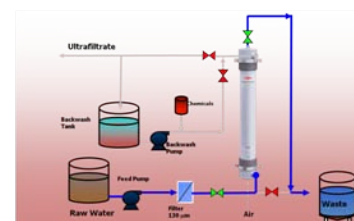


Diagram – Forward Flush





# Tonka Ultrafiltration

The 2 steps of **backwash** and a **forward flush** are performed to remove any remaining contaminants on the outside of the fibers. After a CIP and at the start of the **operating** step, permeate may be used to remove residual chemicals held in the fiber or module. The CIP steps described above are for a single alkali or acid chemical solution. If an acid and alkali cleaning are required, the CIP steps would be repeated for each chemical solution.

## Tonka Ultrafiltration for Small Community Water Systems



100-300 GPM Systems