Table 3 Recommended Crossflow Rates

	Crossflow	ΔP
LP Screen	4-8 L/min/m^2	10 psi (0.7 bar)*
EP Screen	6-12 L/min/m^2	5 psi (0.35 bar)*
J Channel	10-15 L/min/m^2	<1 psi (0.07 bar)
* Typical ΔP measured with water and permeate closed		

Table 4 Maximum Recommended Operating Pressures

Maximum Operating Pressures at 30°C	
Forward	100 psi (7 bar)
Reverse	7 psi (0.48 bar)

Table 5 Air Integrity Test Specification

Air Diffusion Rates	
Ultrafiltration 1kD thru 5kD	≤ 323 sccm/m^2 @ 15 psi (1 bar)
Ultrafiltration 10kD thru 300kD	≤ 323 sccm/m^2 @ 7.3 psi (0.5 bar)
Microfiltration ≥ 0.1 um	≤ 323 sccm/m^2 @ 3 psi (0.2 bar)

Maximum Operating Temperature 50°C

CHEMICAL COMPATIBILITY

TangenX™ SIUS™ membrane cassettes are compatible with the following:

- ACN (<15%)
- DMF, DMSO (<40%)
- DMAC (<15%)
- Phosphoric acid (<1M)
- Sodium Hypochlorite (<400ppm)
- Sodium Hydroxide (<0.5M)

TangenX™ SIUS™ membrane cassettes are NOT compatible with the following:

- Pure aromatic and chlorinated hydrocarbons
- Ketones
- Polar aromatics
- Aliphatic esters

A more comprehensive list is available in the cassette validation guide.

CAUTION

In the event that the cassette is subjected to any of the conditions listed below, it is recommended that you perform both cassette integrity and water flux tests to ensure your cassette is not damaged. Damage may occur as a result of the following:

- Dropping on hard surfaces, or other mechanical shock.
- Poking with sharp objects on screened surfaces
- Excessive feed pressure.
- Excessive permeate backpressure, or pressurizing the filtrate port.
- Exposure to harsh chemicals.
- Freezing.
- Excessive heat.
- Drying out – ultrafiltration or microfiltration membrane that is allowed to dry out can permanently damage the pore structure.

MEMBRANE CASSETTES MUST REMAIN WET AT ALL TIMES TO MAINTAIN PRODUCT INTEGRITY AND PERFORMANCE.

FOR TECHNICAL SUPPORT OR ORDER ASSISTANCE PLEASE CALL YOUR LOCAL SALES REPRESENTATIVE.

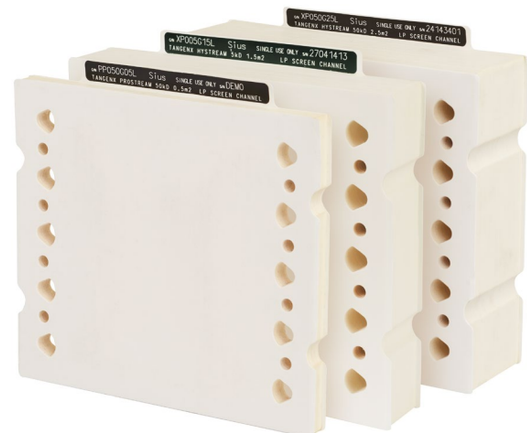
REPLIGEN TANGENX™ STANDARD WARRRANTY

Repligen Corporation warrants its TangenX™ products will meet their applicable published specifications when used in accordance with their applicable instructions for a period of one year from shipment of the products. **REPLIGEN MAKES NO OTHER WARRANTY, EXPRESSED OR IMPLIED. THERE IS NO WARRANTY OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE.** The warranty provided herein and the data, specifications and descriptions of Repligen TangenX™ products appearing in published catalogues and product literature may not be altered except by express written agreement signed by an officer of Repligen. Representations, oral or written, which are inconsistent with this warranty or such publications are not authorized and if given, should not be relied upon.

In the event of a breach of the foregoing warranty, Repligen's sole obligation shall be to repair or replace, at its option, the applicable product or part thereof, provided the customer notifies Repligen promptly of any such breach. If after exercising reasonable efforts, Repligen is unable to repair or replace the product or part, then Repligen shall refund to the customer all monies paid for such applicable product or part. **REPLIGEN SHALL NOT BE LIABLE FOR CONSEQUENTIAL, INCIDENTAL, SPECIAL OR ANY OTHER DAMAGES RESULTING FROM ECONOMIC LOSS OR PROPERTY DAMAGE SUSTAINED.**

TangenX™ SIUS™ Cassette

USER GUIDE



REPLIGEN
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PRODUCT CONTENTS

Package includes the following:

1. TangenX™ SIUS™ membrane filtration cassette: product consists of either a 0.5 m^2 (5 ft^2) cassette, 1.5 m^2 (15 ft^2), or a 2.5 m^2 (25 ft^2) single-use cassette
2. EPDM gaskets

IMPORTANT INFORMATION BEFORE YOU BEGIN

CASSETTES

- Product is packaged wet and must remain hydrated for optimal performance. Keep bag sealed until cassette installation (step 3 below).
- TangenX™ SIUS™ Cassettes are compatible with the TangenX™ PRO cassette holder. A list of other cassette holders is shown in the cassette holder compatibility guide.
- Cassettes may be stacked to increase filtration surface area; however, use only one type of membrane molecular weight cutoff at one time. *Do not install a mixture of cassettes with different pore sizes in the hardware.*
- Cassettes must be equilibrated with an appropriate buffer (i.e., phosphate buffered saline) to ensure the neutralization of the 0.2M sodium hydroxide storage agent in the membrane filter. It is important to use pre-filtered buffer to avoid fouling the membrane or introducing contaminants into the system that could affect membrane performance and product recovery.

GASKETS

- Gaskets are intended to be single use; Repligen recommends that you replace gaskets with each cassette changeover. Repligen supplies two gaskets per cassette. Installation of the first cassette requires two gaskets; stacking additional cassettes requires only one gasket. Extra gaskets should be saved to replace worn or damaged gaskets.

PUMP

- When using TangenX™ cassettes, select a pump with adequate capacity. Crossflow rate ranges (see Table 3) are feed channel type and process fluid dependent.

TANGENX™ SIUS™ CASSETTE INSTALLATION

1. Lift the end plate off the manifold of the TangenX™ PRO cassette holder.
2. Rinse the EPDM gaskets with deionized water or WFI. Place a rinsed gasket flat against the bottom manifold; ensure that the holes in the gasket line up with the holes in the manifold.
3. Using scissors carefully open the cassette bag to remove cassette.
   WARNING: Each cassette is stored in 0.2M sodium hydroxide solution as a preservative. Follow standard safety procedures for handling 0.2M sodium hydroxide, including the use of gloves, safety goggles, and lab coat.
4. Place the cassette into the holder flat against the gasket. Place another gasket on top of the cassette. Ensure that the holes in the manifold, gaskets, and cassette are completely aligned. If you are using multiple cassettes, continue the same gasket/cassette/gasket pattern, ending with a gasket between the last cassette and the end plate.
5. Place the end plate on top of the last gasket of the cassette or cassette stack.
6. Install the tie-rod spacers (if used) and washers on each bolt leaving a minimum of 18 mm (0.75 inch) of thread exposed on the rod. By hand, screw the nut on each bolt and hand tighten evenly by alternating from one nut to the other.
7. Bolts must be further tightened to within the recommended torque values as shown in Table 1 using a calibrated manual torque wrench.

Table 1 Recommended Torque Values

Holder Type	Torque Range (in-lbs)	Torque Range (nm)
TangenX™ PRO 4-BOLT	300 – 450	35 – 50
TangenX™ PRO 2-BOLT	600 – 900	70 – 100

8. Figure 1 illustrates the bolt patterns for the two holder types: TangenX™ PRO 4-bolt horizontal cassette holder is designated by letters H1 through H4; TangenX™ PRO 2-bolt vertical holder is designated by letters V1 and V2.
9. **4-bolt torque sequence:**
   Using the calibrated torque wrench with a 1-¼" deep style socket, place the socket on bolt H1 and tighten the nut ¼ turn. Then move the wrench diagonally to bolt H2 and tighten the nut ¼ turn. Next move the wrench to bolt H3 and tighten the nut ¼ turn. Then move the wrench diagonally to bolt H4 and tighten the nut ¼ turn.

Figure 1
Torque Sequence for TangenX™ Sius™ Cassettes

   Alternate back and forth using this crisscross pattern until the torque wrench "clicks" at each nut. Repeat this sequence until the wrench "clicks" without turning the nut. The "click" of the torque wrench indicates that the nut has reached the set point torque value.
10. **2-bolt torque sequence:** Using the calibrated torque wrench with a 1-¼" deep style socket, place the socket on bolt V1 and tighten the nut ¼ turn. Next move the wrench across to bolt V2 and tighten the nut ¼ turn. Alternate back and forth until the torque wrench "clicks" at each nut. Repeat this sequence until the wrench "clicks" without turning the nut. The "click" of the torque wrench indicates that the nut has reached the set point torque value.
    CAUTION: Nuts must be tightened uniformly to avoid damaging the cassette. Leakage may result from non-parallel plate alignment or over-compression of the cassettes at one end.
    Wait 5-10 minutes and allow the gaskets to relax before re-torqueing. Check each nut, per the Figure 1 sequence, using the torque wrench at its set point torque value (see step 7 above).
11. Re-torque as needed to create a liquid-tight seal, but do not exceed the maximum torque limit for the TangenX™ PRO holder type used (see Table 1).
    NOTE: Torque may change during processing as the cassettes may compress, or as the cassettes expand or contract with temperature changes. Periodically check the torque of the bolts and adjust torque as needed.

EQUILIBRATION OF TANGENX™ SIUS™ CASSETTES

Cassettes must be equilibrated with an appropriate buffer (i.e., phosphate buffered saline) to ensure the neutralization of the 0.2M sodium hydroxide storage agent in the membrane filter. Verify the pH of the effluent from the cassette is neutralized to minimize any possible interaction with your particular application. For most applications, further sanitization is not required.

INTEGRITY TEST

The integrity test is a non-destructive method to verify the integrity of a TFF cassette. Each cassette manufactured by Repligen undergoes strict release testing, including an air integrity test. This release test verifies the integrity of the cassette prior to shipment; however it can't guarantee the integrity of the cassette's installation in the holder at the time of use. In the rare case there is an integrity issue, it can be a result of shipping damage or improper installation. Therefore, a pre-use integrity test should be conducted on site and can easily be performed following the cassette installation and flush. Integrity test specifications are shown in Table 5 of this guide. A detailed procedure (AN1002) for the measurement of air integrity can be obtained by contacting Repligen or your local sales representative.

CLEANING OF THE CASSETTE SYSTEM

TangenX™ SIUS™ cassettes are intended for single use only, post-use cleaning and re-use is not recommended. To clean the TFF system following use, recirculate 0.5M sodium hydroxide through the system with all valves open. Cassettes are left in place during the system cleaning procedure to provide a flow path for the cleaning solution. Alternatively the cassettes may be removed and a spacer gasket[1] is put in place of the used cassettes. Upon completion of the cleaning cycle, flush the system with WFI, or DI water prior to draining and discarding the cassettes. Table 2 lists possible recommended cleaning solutions. [1] Spacer gaskets for flushing may be obtained by contacting Repligen.

Table 2 Recommended Cleaning Solutions

Cleaning Agent	Cleaning Conditions
0.5N Sodium Hydroxide	Contact Time = 30 – 60 minutes Temperature = 35°C (95°F)
1.5% Alconox® Detergent	Contact Time = 30 – 60 minutes Temperature = 40°C (104°F)

DISPOSAL OF USED TANGENX™ SIUS™ CASSETTES

TangenX™ SIUS™ cassettes are removed from the holder by reversing the cassette installation procedure. If the cassettes are difficult to separate from the stainless steel holder, a thin plastic spatula[2] can be slid under the edge of the cassette and break the seal. Cassettes can then be disposed of in a similar fashion to other disposable process equipment. [2] One cassette extractor is included with each shipment of TangenX™ SIUS™ cassettes.

STORAGE OF UNUSED TANGENX™ SIUS™ CASSETTES

Membrane cassettes must remain sealed in their original packaging prior to use to maintain their characteristics, integrity, and prevent microbial growth. Below are critical factors to remember when storing unused TangenX™ SIUS™ cassettes:
Recommended storage temperature:

- 4°C - 25°C long term (> 7 days)
- 50°C short term (< 7 days)
- Do not freeze cassettes

MEMBRANE OPERATING CHARACTERISTICS

Take care to use the membrane at the lowest pressure possible while still producing consistent permeate flow. Although higher operating pressures initially improve flow rate, they also promote increased concentration polarization and membrane compaction, which ultimately limits flow. With very low NMWL membranes, lower operating pressure may also reduce the retention of salts and very low molecular weight species.