

NSF 419 Direct Integrity Test Procedure

The test procedure is based on NSF 419 test report from 17-Feb-2023 and valid for the following certified ceramic flat membrane modules:

- CFT-0000-SMSEC4-2022
- CFT-0000-BMSEC4-2022



Certified to
NSF/ANSI 419



A. NSF test report summary information

NDPT method and QCRV		
NDPT method (e.g., pressure decay, etc.)	3-minute pressure decay from 15.23 psi (1,050 mbar)	
QCRV (include units)	0.012 psi/min (0.83 mbar/min) for fully wetted membranes	
Equations for use in determining LRV _{DIT} , ALCR, and DIT pressures		
LRV _{DIT} equation	$LRV_{DIT} = \log_{10} \left[\frac{Q_P \times ALCR \times P_{atm}}{\Delta P_{test} \times V_{sys} \times VCF} \right]$	
ALCR equation	$ALCR_{Turbulent} = 170 \times Y \times \sqrt{\frac{(P_{test} - BP)(P_{test} + P_{atm})}{((460 + T) \times TMP)}}$	
DIT pressure equation	$P_{test} = (0.193 \times K \times \sigma \times \cos\theta) + BP_{max}$	
Constants for use in determining LRV _{DIT} , ALCR, and DIT pressures		
Constant	Unit	Value
Volume of pressurized air in module during DIT (V)	gal / liters	2.76 / 10.46
Volumetric concentration factor (VCF)	---	1
Net expansion factor (Y)	---	0.86
Filtered water channel (L x W)	inch / mm	0.08 x 0.08 / 2 x 2
Defect length (l)	µm	3
Pore shape correction factor (K)	---	1
surface tension at the air-liquid interface (σ)	dynes/cm	74.9 at 5°C water temperature
Liquid membrane contact angle (θ)	degrees	0°
Maximum flux rate	GFD / LMH	315 / 535

NDPT = Nondestructive performance test
 QCRV = Quality control release value
 DIT = Direct integrity test
 LRV = Log removal value
 ALCR = Air-liquid conversion ratio

P = Pressure
 BP = Backpressure on the system during the test
 T = Feed water temperature
 TMP = Transmembrane pressure

B. Test Procedure

The following automated process shall be incorporated into the standard operating procedure of the Water Filtration System and executed successfully at least once prior to operation in each 24-hour operating period. Pressure levels specified are unique for certified the products:

1. Filtration operations shall be paused or stopped, backwash process initiated, and effluent valves are adjusted to “Closed” position.
2. Degassing valve shall be opened to neutralize TMP.
3. Filtration tank shall be filled with water, either treated unfiltered water or filtered water, and the membranes fully wetted and fully submerged with water to level BP_{max} above the membranes (see figure 1).
4. Compressed air shall be introduced into the filtration piping and ceramic membrane modules reaching a controlled test pressure of 15.23 psi (1,050 mbar) + BP_{max} within 60 seconds. Once control pressure is reached, additional air flow stops.
5. During the following three (3) minutes, the pressure decay shall not exceed 0.012 psi/min (0.83 mbar/min) or a total loss of 0.036 psi (2.49 mbar) in three minutes.
6. Pressure readings shall be recorded every 30 seconds and saved automatically on the Water Filtration Equipment control system for all Direct Integrity Tests.
7. At no time during the test shall the measured pressure drop below 15.194 psi (1,048 mbar) + BP_{max} .
8. Test completion options:
 - a. **Passed test** – if residual pressure is maintained above the prescribed limit during both the Stabilization Period and the Monitoring Period, then the test will end and the Water Filtration Equipment will automatically begin plant start up sequence and commence water filtration;
 - b. **Failed test** – if residual pressure is not maintained above prescribed limit during both the Stabilization Period and the Monitoring Period, then the test will end immediately and the Equipment will shut down. Prior to restarting the Water Filtration System operator intervention will be required and a successful test must be completed.
 - c. **Remediation** – in the event of a failed integrity test, the operator may isolate filtration equipment responsible for the failure and re-test remaining equipment until satisfactory results are achieved. Any filtration equipment observed or suspected of failure is to be replaced or repaired prior to be returned to service.

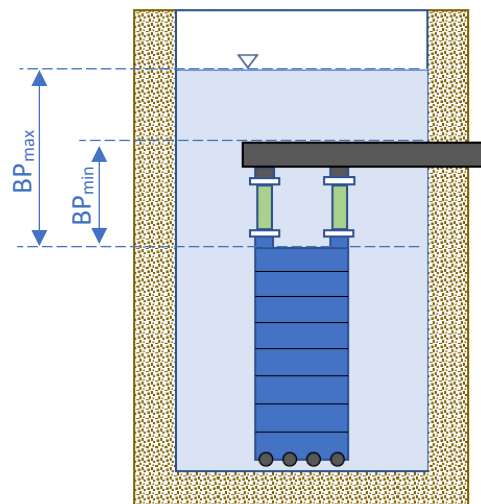


Figure 1: Submerged membranes in tank; Water level BP_{max} to be always $> BP_{min}$;
Recommendation $BP_{max} = BP_{min} + 1.0 \text{ ft (0.3 m)}$

C. Components

1. Pressure Transducer and Pressure Indicator – 4-20 mA analog output to Control Panel and LED display.
2. Compressor – shared duty with instrument air compressor (oil-free) and accessories.
3. Pressure regulating valve – reduce control air to test pressure.
4. Over-pressure relief valve – set to protect membranes from damage.
5. Control panel – integrated with main PLC; process initiated manually or automatically when plant is re-started.