LG QuantumFlux™ Pressurized UF Membrane

Technical Service Bulletin 606

UF Membrane Integrity Testing and Repair

Integrity testing is used to confirm that the system and modules are intact. If membrane fibers are damaged or broken, or module or skid seals are not made correctly, feed water may pass to the filtrate side of the membrane and filtrate quality may be affected. This may be indicated by an increase in turbidity. Therefore, it may be necessary to conduct an integrity test and repair any damaged membrane fibers or leaking points.

Integrity Test principle

Pressurized air is applied to one side of the wetted membrane fibers. If the membrane integrity is intact, and the air pressure is lower than the bubbling point, there will be no observable air flow from the membrane pores. However, if there are damaged membrane fibers, air flow can be easily observed at pressure far below the bubbling point. Therefore, the integrity of a membrane module can be tested by observing bubble flow or the pressure change on one side of the membrane fibers.

System Integrity Test Procedure

⚠ **CAUTION**: The compressed air used for integrity testing must be oil free. Dirty air will contaminate the membrane. The maximum air pressure allowed during testing is 100kPa (14.5 psi).

⚠ **CAUTION**: The testing should be completed in less than 5 minutes. Immediately after testing, the modules must be filled with water.

The following procedure is used to confirm system integrity and identify any integrity breach in need of repair.

1. Fill up the skid with water to make the membrane modules completely wet.
2. Open the integrity test (IT) valve (AV-04) and the concentrate valve (AV-06). Compressed air applied through the integrity test valve will drive the water from the filtrate side of the membrane to the feed side. As water evacuates and air fills the feed side, the pressure will slowly increase until it reaches a regulated set point, which should be less than 100KPa (14.5 psi).
3. Allow the pressure to stabilize at the set point, typically ~2 minutes. This will occur once all the water on the feed side of the membrane has been evacuated.
4. After the pressure has stabilized, close the IT valve. Note the pressure.
5. Hold the pressure for 5 minutes.
6. Typically, if the pressure drop is less than 17 KPa (2.5 psi) in 5 minutes, the system integrity is intact. If the pressure drops rapidly, it indicates that there is a leak in the system.
7. Check the transparent pipe section at the top of each module for leaks. If vigorous bubbles are observed in the transparent pipe of a module, it should be removed for further testing and repair.

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Removal of Membrane Modules

⚠ **CAUTION**: Use two people when handling 6” modules. Use a forklift, or other lifting device, when handling 10” modules.

⚠ **CAUTION**: Once the membrane fibers become dry, the filtration performance of the module may deteriorate or even be totally lost. When removing the membrane prevent it from drying out due to air.

1. When necessary, remove the membrane module according to the following instructions:
2. Prior to removal, use the chemical cleaning pump to rinse all the modules on the same skid with approximately 2 skid volumes of clean water.
3. Stop the operation of the skid.
4. Open the drain valve for the skid and discharge the water from the membrane module through the feed/discharge port.
5. Disconnect the module at the filtrate port(s), followed by the feed/drain port. Leave the top concentrate port connected.
6. For 6” modules: Use two people. One person should hold the membrane module steady, while the other makes the disconnection by unscrewing the union nuts.
7. For 10” modules: Use two people. Connect the module to the lifting device. Disconnect by undoing the grooved end style couplings.
8. Use one person to hold the module steady, while the other makes the final disconnection.
9. Lift the module from the skid and place horizontally on the ground, with the side ports facing up.
10. Cap all the ports of the module immediately using the sealing caps.

Individual Module Integrity Test Procedure

The individual module integrity test includes bubble testing, fiber pinning, and a membrane leak test. Each of these procedures is described below.

⚠ **CAUTION**: Use two people when handling 6” modules. Use a forklift, or other lifting device, when handling 10” modules.

⚠ **CAUTION**: Properly support the module with straps to prevent the module from falling over.

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Bubble Test Procedure

After removing the suspect module from the skid, perform an integrity test on the module according to one of the following procedures:

For 10” modules

1. Remove the top end cap.
2. Install integrity test kit, as shown in Figure 1.
    1) Fix clamp on filtrate end of module with the eye bolts pointing out from module.
    2) Insert air supply adaptor in the central opening of the module.
    3) Move eye bolts into slots of the fixing bar.
    4) Tighten wing nuts on eye bolts until the fixing bar cannot move.
    5) Connect compressed air supply line.

Note

Do not apply excess force. Excess force may damage the module. The fixing bar is only intended to prevent movement of the air supply adaptor

Figure 1: Integrity Test Kit for 10" Modules

3. Compressed air supply line should be regulated to a maximum pressure of 1.3 bar (19 psi).
4. Equip compressed air supply line with air pressure vent valve.
5. Place the module in a clear rectangular tank full of water so that it is fully submerged. Fix the module in place, below the water level. The filtrate end of the module must be accessible and clearly viewable.
6. Apply a small amount of pressure on the membrane of 50-100kPa (7.2-14.5 psi), never more than 15 psi.
7. If vigorous bubbling is observed on the surface, one or more membrane fiber(s) are damaged and need to be isolated from operation. Proceed to procedure B below.
8. If vigorous bubbling is not observed, proceed to procedure C below.

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For 6” Modules

1. Fix module on testing stand vertically (the feed water port down).
2. Dismantle the clamp and end cap of the two ends.
3. Seal the concentrate port and feed water port with sealing cap.
4. Connect compressed air to the air inlet.
5. Apply a small amount of pressure on the membrane of 50-100kPa (7.2-14.5 psi), never more than 15 psi.
6. Spray clean water on the end surface of the potting.
7. If bubbling (like a fizz) is observed on the surface in a specific location, one or more membrane fiber(s) are damaged and need to be isolated from operation. Proceed to Fiber Pinning Procedure below.
8. If bubbling (like a fizz) is not observed, proceed to Module Leak Test Procedure and Repair below.

Fiber Pinning Procedure

1. Once the source of the bubbling has been identified, turn off the pressurized air.
2. Insert a LG Chem repair pin into the opening of the damaged fiber and press it in until 2/3 of the pin is inside the module.
3. Cut the pin. Do not pull the pin out while cutting.
4. Press any extruding portion of the pin into the fiber.
5. Follow the bubble test procedure above to make sure the broken fiber is completely sealed.

After the completion of repairing the top filtrate side, the membrane module is turned upside down and is repaired as per above procedure.

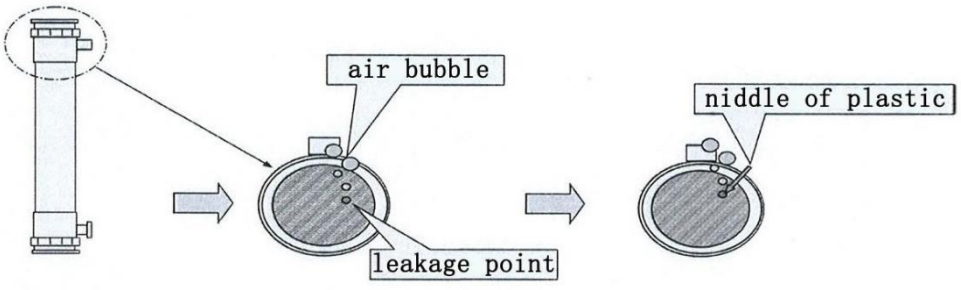

Figure 2: Membrane Repair Procedure

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Module Leak Test Procedure and Repair

1. Install end cap and clamp at discharge/filtrate port end. Cap the concentrate and feed ports.
2. Place the module horizontally in a water tank large enough to completely submerged it in water.
3. Connect an air supply and pressure gauge.
4. Apply up to, but never exceeding, 0.1MPa (14psi) of air.
5. For the first minute or two air that has been trapped may escape. After that the pressure should hold steady.
6. Observe any air bubbles from the housing, or clamp joints. If a bubble is observed, mark the leaking point.
7. If leak is found around a clamp joint, simply replace the old O-rings with new ones. If the housing is the source of the leak, it can be repaired using epoxy resin. Contact LG Chem for recommendation on selecting an epoxy resin.
8. Repeat Steps 4-7 until no leakage is detected on the module.

Figure 3: Membrane Module Leak Test