Technical Service Bulletin

JANUARY 2019 TSB 334.04

Bubble Testing and Fiber Repair for HYDRAcap® MAX Modules

This Technical Service Bulletin provides information for locating and repair of compromised fibers within either a conventional HYDRAcap® MAX rack or HYDRAcube skid.

Bubble Testing

Once a module has been determined to have a leak, from integrity testing (see TSB 333), the module must be removed from the rack for bubble testing. Bubble testing is used to determine location of the leak(s). When the module is properly fitted with Hydranautics' bubble test apparatus, it then becomes a matter of watching for bubble formation from the leak source. Continuous large bubble formation will be indicative of a compromised fiber. The following will be required to perform a bubble test:

- Hydranautics' bubble test apparatus.
- Air hose with ¼" (NPT) male pipe thread.
- Pressurized air (oil free) and pressure regulator set to 1 bar (15 psi).
- Tools for removing HYDRAcap® MAX module end caps
  - Rubber Mallet
  - Crescent Wrench or Similar Tool
  - 17 mm and 5/8" Wrench
- Squirt bottle or water bath.
- A flashlight is useful for viewing the fiber ends and locating specific leaks.

1. Drain water from rack. Remove suspect module(s) and seal manifold piping connections with caps (not supplied).
2. Disassemble module (see TSB 336 for HYDRAcap® MAX and TSB 356 for HYDRAcube).
3. Fill module with clean water to ensure fibers do not dry out.
4. Insert bubble test plug apparatus into both ends (see Figure 1). Ensure O-rings are intact before inserting adapters to ensure proper seal.

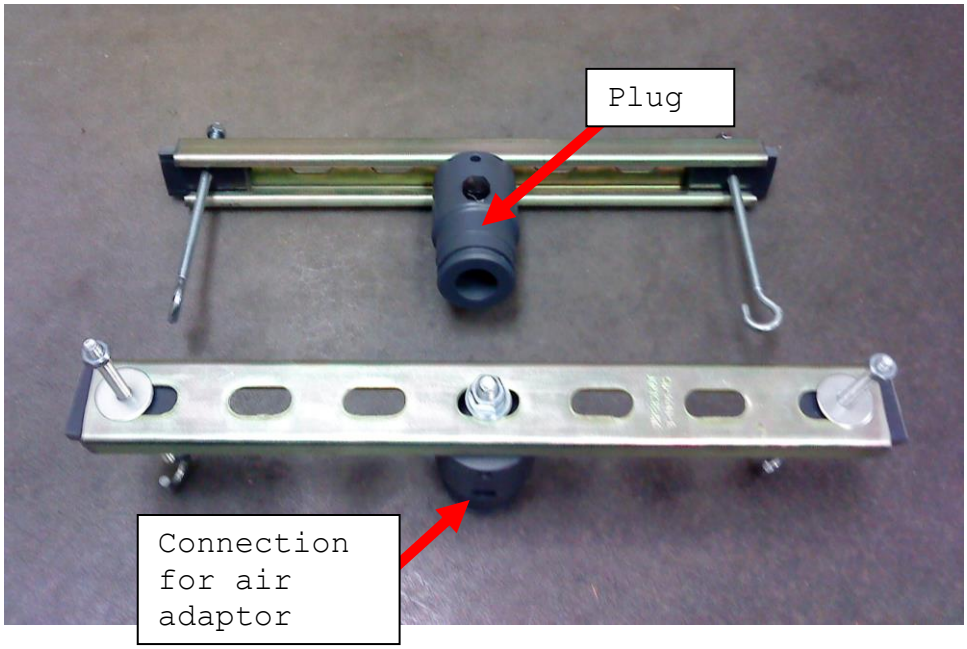

***Figure 1:* Assembly Kit of Hydranautics Bubble Test Apparatus**

5. Attach the half shell stainless steel clamps back onto the HYDRAcap MAX module without the black end caps (See Figure 2 below).

***Figure 2:* Clamp and air inlet locations.**

6. Connect the fish hook clamp to the bolts of the half shell clamps (See Figure 3 below).

<u>Figure 3:</u> Fish hook connection points on clamps.

7. Slide other ends of the fish hook clamp into the plug apparatus and hand tighten the nuts evenly to ensure good seals of the plugs.
8. Connect air source with female quick connection (provided with apparatus).
9. Once all necessary connections are made, there are two methods to bubble test:

    - A squirt bottle filled with water
    - Submerging the entire module into a tank.

10. For the first method, air should be slowly introduced. Once the air pressure has been adjusted to approximately 15 PSI using a regulator, water from the squirt bottle can slowly be poured over the ends to detect the broken fibers. In the case of using the squirt bottle, you will be able to see an air stream coming out of the broken fibers. The squirt bottle can be used to help detect these air streams, as it will push away the water.

<u>Figure 4:</u> Air stream example using a bottle with water.

11. Second method: Submerge the module into a tank filled with water. Make sure that the tank is completely full to ensure that module will be completely submerged. Air should be slowly introduced and pressure regulated to 15psi with the air regulator. At this point, water may overflow the tank. After all the water from the filtrate has been displaced by air, leaking fibers will then be evident by the presence of streaming bubbles

    - **NOTE: All fibers should be completely immersed in water. Be aware that upon pressurization, water will push through the fibers and overflow the test apparatus.**

In the case where the module is submerged in a tank, observe bubble formation on both sides of the module. Compromised fibers will show large continuous bubble formation. If the fiber damage is severe, extremely vigorous bubbling will obscure vision; reduce the pressure to proceed.

- **NOTE: Small bubbles are common and a result of air diffusion through membrane pores. Diffusion rates are proportional to air pressure so initial bubble testing at lower pressure (i.e., 5 psi) may be beneficial.**

12. If a compromised fiber is located, it must be “marked” by plugging it with a fiber repair pin (PN: 11612.0000).

***Figure 5:** Temporarily installing pins into broken hollow fibers.*

13. Once all suspected leaking fibers have been “marked”, shut off air supply and bleed air from the module.
14. Remove the module from the tank if necessary.

Fiber Repair

To restore integrity (“membrane barrier”) of the module, all leaking fibers should be isolated or rendered inactive by permanently plugging them with Hydranautics’ repair pins. The polysulfone pins are permanently bonded to the inside fiber wall by first applying Loctite 4061 adhesive to the pins and then pressing them into the leaking fiber. The following items are required for fiber repair:

- Hydranautics’ repair pins (PN: 11612.0000) – 6 pins per assembly
- Loctite cyanoacrylate 4061 adhesive (PN: 20004.2000).
- Utility knife or razor blade.

1. At this point the module should be depressurized, drained of all water and the “marker” repair pins should be inside suspect fibers. Apply the Loctite adhesive to a new pin, immediately remove a “marker” pin, and replace it with the new pin. Repeat as necessary.

***Figure 6:* Permanently installing repair pins with Loctite 4061**

2. The bonding of the pins should take no more than one minute. Carefully remove any residual length of pin with a utility knife or blade.
3. Repeat bubble test, with special care to check at low pressure, 0.5 psi and slowly up to higher pressures, 15 psi to verify no leaks are present.
4. Reassemble module (see TSB 336 for HYDRAcap® MAX or TSB 352 for HYDRAcube).
5. When all modules are completed, verify Integrity by performing an integrity test (see TSB 333).

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