CARING FOR ACRYLICS

by Kenneth Capek RRT, CHT, MPA

A hyperbaric chamber is a large financial investment for an institution. It deserves special handling and care to keep it operating properly for years of patient service. The acrylic part of a chamber is clearly the most visible part and requires the most protection from misuse and damage. This is the case when caring for the round acrylic "window" of a monoplace chamber or flat window port of a multiplace chamber. All manufacturers will provide their instructions for the proper care and maintenance of their products. As for the acrylics, these instructions are important guides to ensure that no damage occurs to these very expensive units. In general, the manufacturer will recommend that the unit be covered when not in use with the door closed and prohibit unauthorized personnel access to this area. This would include housekeeping staff that may move the chamber improperly to clean under it or use abrasive harmful cleaners on the surface. Environmental services staff should be educated about working in and around the chamber area! Hyperbaric departmental staff will have primary responsibility for the actual cleaning of the chamber itself. Each manufacturer has its own list of "approved" cleaning and disinfecting solutions, which can safely be used on their chamber. These are the only products that should be used. The department should have a policy and procedure on how to clean and care for the chamber and how often and it should be specific to its various components, i.e.; mattress, gurney, ground bracelet, chamber surfaces. The hospital infection control authorities should review and approve these procedures to ensure compliance with hospital-wide policies. Abrasive cleaners can damage the surface of an acrylic chamber and must be avoided. Alcohol and other fast drying solvents, strong base and acid products should be avoided since they will cause crazing of the acrylic surface. Crazing can best be detected by inspecting the chamber at an angle in a lighted area or with a light source. Crazing has the appearance of little cracks or fissures inside the acrylic but these are typically on the surface. Ultra-violet light can also cause crazing and yellowing of the chamber. For this reason chambers should be protected from direct sunlight, sun lamps and mercury vapor lamps. Window film shielding may be indicated. Sechrist (the manufacturer of the chambers I use and manual referenced) recommends using a damp, 100% cotton, and lint-free cloth for cleaning. It is important to note that lint build-up inside a chamber can be more dangerous than not using 100% cotton linen in regard to accumulating fire ignition fuel. Sechrist also states that water should not be allowed to pool on the bottom of the chamber because it may "drain into and contaminate the supply piping system". This is something we frequently check because patients sometimes spill their cups of water or juice inside the chamber, even though we use "sippy" cups to prevent this from happening. Department policies and procedures should address performance of daily inspections for possible damage such as scratches and scraps to the acrylic surface. Sometimes the air-break demand valve can leave a mark on the inside acrylic. These blemishes can safely be removed with an approved acrylic polish such as "NOVIS". Although not a complicated task to perform, the instructions must be followed to get proper results and not cause further damage. You may be amazed at how well these scratches and scruffs can be removed leaving a shiny clear chamber looking brand new again. If the damage is more serious like a deep scratch or cut in the acrylic, the manufacturer should be contacted for a repair. One way to determine if the scratch is too deep for you to fix is the "fingernail test". Drag your nail across the surface of the chamber where the scratch is located. If the depth causes your nail to sink into the scratch, it may be too deep for self-repair polishing procedures. The minimum allowable depth of a scratch is 0.02 X the window thickness. If the window is 1 inch thick the minimum allowable depth would be 2 hundredths of an inch or the thickness of two business cards. The Sechrist manual states that for "major scratches (.010 inch deep or deep-

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er) that they be contacted immediately" and that "deep crazing or scratches can cause the acrylic cylinder to rupture – do not use". It may be difficult for the user to actually know how deep is too deep. There are sophisticated tools that can be purchased and used for the precise determination of scratch depth, although they can be quite costly.

According to the ASME, PVHO-1 standard, the life expectancy of an acrylic chamber is 10 years, 10,000 cycles or 40,000 hours, whichever comes first. ASME stands for the American Society of Mechanical Engineers, which was founded in 1911 to develop standards for the design, fabrication, testing and stamping of boiler and pressure vessels. PVHO-1 (Pressure Vessels for Human Occupancy) are the rules their Technical Committee published in the 1970's.

PVHO-1 relates to the manufacturing specifications and requirements for hyperbaric chambers. This document addresses many specifications for a chamber such as the required thickness of the acrylic window and minimum pressures it must withstand which are much higher than what we would currently use for therapy. Interestingly these rules also cover chambers that deliver pressures down to only 3 psi. It is from this document we get the design life expectancy time and use limits for a chamber. Sechrist (and other manufacturers) recommend a mechanical refurbishment once a chamber reaches its 10-year old birthday. This will be an expensive party and usually requires that the chamber be shipped back to the manufacturer. The cost may be over $30,000 and can reach almost $50,000 if you include the replacement of the acrylic tube, round trip freight not included. A loaner chamber may be available to prevent interruption of services during the refurbishing period.

PVHO-2 provides guidance to the user and/or authority in regard to the potential service life of the acrylic chamber and the necessary care, inspections and repairs during this period. This is important because these newer rules state that the cylindrical window chamber may be operated for an additional 10 years or 10,000 cycles (a total of 20 years or 20,000 cycles) if the PVHO-2 inspection program is performed and adhered to. The inspection program is outlined in PVHO-2 and addresses certain acrylic chamber components, which require daily inspections and full inspections every 2 years after its 10-year design life. The chamber must be located in a protected environment such as inside a building and maintained properly. Reference the PVHO-2 standard for more detailed specifications regarding procedures and documentation requirements. Again, extending the life of the acrylic chamber can save significant expense for a department.

For more information about acrylics there is a specific course that one can attend in San Antonio, Texas given by International ATMO. This half-day acrylics course can be taken following the safety director course, which they also offer. I recommend taking both back-to-back. Proper care of your chamber protects your investment, your patients, your staff and yourself.

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