Museum and Library Heating, Ventilating and Air Conditioning Considerations

by Dan Lewis, P.E.

Many small town and school libraries in rural areas, because of cost considerations, are not air-conditioned at all, or are only air-conditioned to "normal" comfort levels of 78°F, 55% rh. Larger libraries and museums often include some form of archival storage, and are usually air-conditioned throughout. The temperature and humidity ranges that are best for books, exhibits, and works of art, do not fall within the normal human comfort range, therefore it is necessary to balance the value of preserving contents, maintaining human comfort, and the initial and operating costs of the air-conditioning systems. Temperature and Humidity Requirements: The ASHRAE (American Society of Heating, Refrigeration, and Air-Conditioning Engineers) 1995 HVAC Applications Handbook has the following to say regarding space conditioning requirements for libraries and museums:

> *In an average library or museum, less stringent design criteria are usually provided than for archives, because the value of the books and collections does not justify the higher initial and operating costs. Low-efficiency air filters are often provided. Relative humidity is held below 55%. Room temperatures are held within the 68° to 72°F range.*
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> *Archival libraries and museums should have 85% or better air filtration, a relative humidity of 35% for books, and temperatures of 55° to 65°F in book stacks and 68°F in reading rooms.*
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> *Art storage areas are often maintained at 60° to 72°F or lower, and 50% rh (± 2%).*

Paper in books made before the 18th century is more stable than more recent paper, which is susceptible to deterioration because of its acid content, and requires lower temperature and humidity for longer paper life.

Microfilm and magnetic tape requires relative humidity be maintained above 35%. Stuffed fur-bearing animals should be stored at 40°-50° F, and 50% rh, and bones and fossils are better preserved at higher humidities.

Archival Storage:

It is very important from a cost point of view, to minimize and organize archival storage as much as possible. Try to get by with as few spaces as possible, preferably one, for most projects. It is much less expensive to provide one archival storage room that is twice as large as two smaller rooms. Don't make the room too small, these rooms typically have very low heating and cooling loads, and it is difficult to find equipment small enough to properly condition a small storage room. If there are only a few items which require special storage, perhaps consideration should be given to making arrangements for storing them at a nearby facility.

It is also important to be realistic about temperature and humidity requirements for these spaces, lower temperatures and tighter bands on allowable swings in temperature and humidity drive up the costs of the mechanical systems and controls serving these spaces.We have used "conventional" computer room air-conditioning equipment to maintain archival storage at 60°-65° F, and 35% rh.

Typical installed mechanical cost for a 10ft x 20ft archival storage room using "conventional" equipment might be $10,000-$15,000. This would include an air-handling unit with DX coil, an outdoor condensing unit with low-ambient controls and hot gas bypass, humidifier with modulating control, charcoal filter, 30% efficient filters, electric reheat coil, and electronic temperature controls. Expect to double or triple that cost if lower temperatures are desired, requiring custom built equipment.

Making this room smaller would not save any mechanical cost, as the equipment is the minimum size available. Making the room twice as large would cost little more, and would probably result in better temperature control because the equipment is less oversized.