

## Design helps aquatic circus avoid “sticky” situation

**What’s an aquatic theater? No, it’s not some troupe that only stages productions of “Moby Dick” and “20,000 Leagues Under The Sea”.**

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With 10,000 sq ft of pool surface area, the designers of the Bellagio Hotel’s (Las Vegas) aquatic circus facility had to make sure that dehumidification made audience members feel like they were near the pool, not in it.



*In Las Vegas, it’s a \$70 million investment as part of the new 35-story Bellagio Hotel, where the world-renowned Cirque du Soleil combines death-defying high-divers and acrobats with skilled swimmers. To mechanical systems engineers, however, it’s a 68,500-sq-ft humidity headache.*

In a project of such magnitude, several relative humidity challenges awaited the designers at Dupras Ledoux Associates (DLA, Montreal), and the piping and sheet metal installers at Hansen Mechanical (Las Vegas). DLA, which worked on the Olympic Village at the 1976 Montreal Games, responded with an innovative hvac design considered unlike anything else in North America.

### **Pooling Resources**

Properly sizing the hvac system was critical because of the humidity variances presented not only by 10,000 sq ft of pool water surface, but also from the many water jets that shoot streams up to 60 ft, plus a giant mist curtain used to project laser light shows.

Especially critical was keeping a 112-by 65-ft deco-

orative glass dome atop the 82-ft-high room free of condensation.

In addition to controlling rh, another design goal was to maintain air and water temperatures at a constant 82° and 84°F, respectively.

Those goals were met with help from a series of “DRY-O-TRON®” DS-242 dehumidifiers by Dectron (Roswell, GA). Four such models took care of

dehumidification needs for the primary space, with each sized to remove up to 1,050 lb of moisture per hour. A smaller, additional model was used to dehumidify the performers' 8-by 25-ft practice and warm-up pool in a separate room backstage.

Because spectator comfort was also a major design consideration, the units were sized to maintain 50% rh. The units also contributed to that end by helping to air condition or heat the space when needed.

DLA parlayed a secondary benefit by using these dehumidifiers: The condensation that drains from the units' coils can be reclaimed and returned to the pool.

"The amount of condensation reclaimed represents one entire pool fill per year," said Mark Palitza, the manufacturer's regional sales manager, noting that the amount is no small consideration in a region where water conservation is a serious political, sociological, and environmental issue.

### Three Ring Air Show

Proper air distribution was also critical for keeping the space free of drafts or ventilation noise. DLA's project engineer Andre Dupras and Luc Fontin, headed a team that sized and specified a high-tech distribution system.

The system, manufactured by H. Krantz TKT GmbH (Aachen, Germany), proved well-suited for meeting noise-suppression needs. That particular configuration is ideal for theaters and concert halls because it is designed to disperse air at such low velocities that the air volume is inaudible to the audience.

"The system is unique in the fashion that it uses the heat plume that leaves the body to pull the air [from the seating floor's 1,350 diffusers] and surround the body with cooler, dehumidified air, without creating a draft," said Craig.

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It distributes air to three critical areas using three different methods.

1. The space over the pool and stage areas controlled using 300 swivel nozzle jet outlets.
2. The bottom of the perimeter walls is handled with 159 flush-mount wall supplies (4-by 24-in. diffusers).
3. Finally, air is moved from under the seating area using 1,350 displacement-seating outlets (6-in.-round diffusers).

While fairly common in Europe, using the cavity under a theater's seating risers as one large plenum to supply 1,350 outlets has never been attempted on such a scale in North America, according to Richard Craig, president of Euro-Tech Products (Denver, NC), the system's distributor.

The result is a complex system and a comfortable environment that probably won't attract much notice from the audience watching the grandest aquatic circus in the world.



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