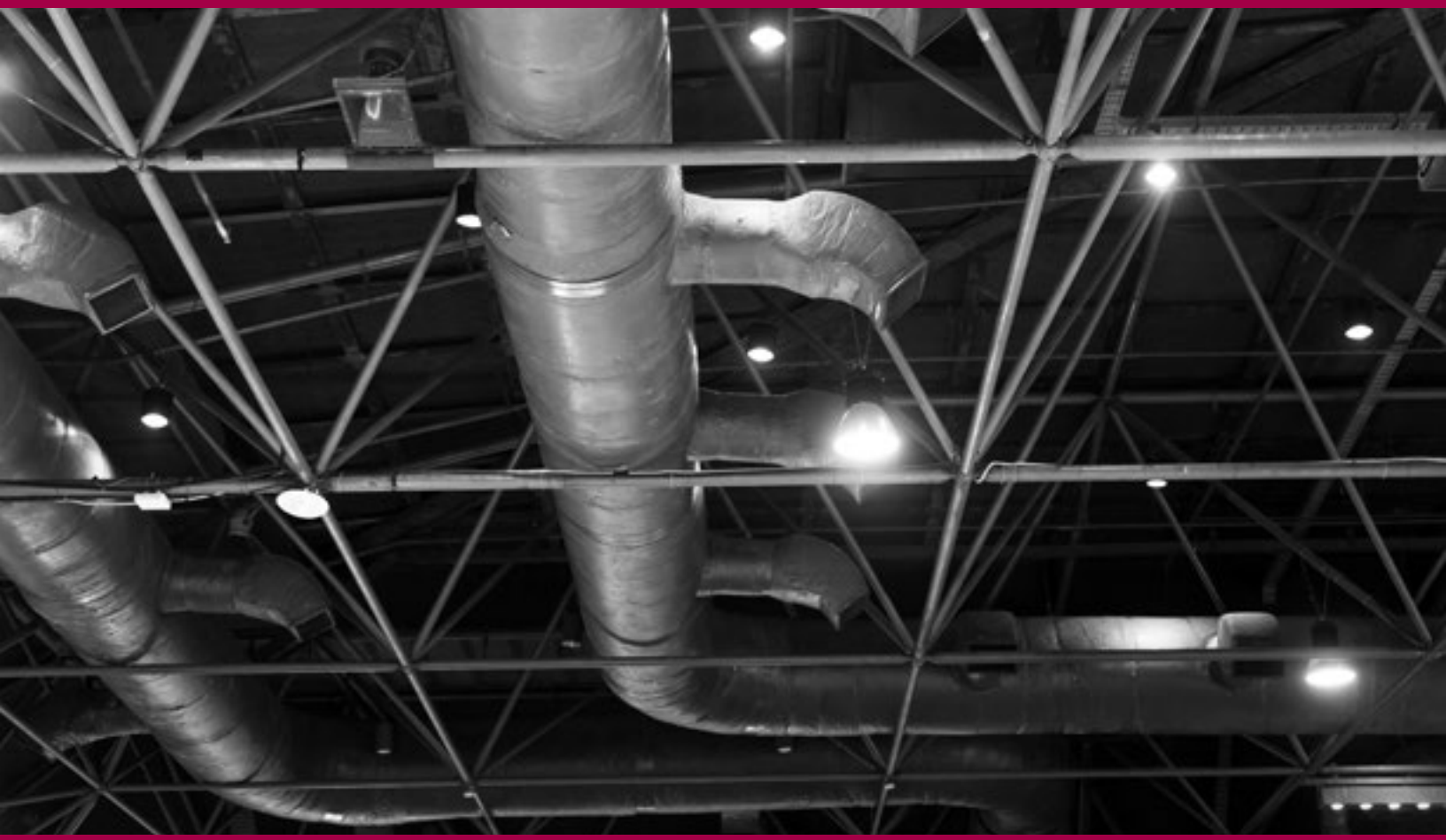
OLC, THE BALLARD GROUP RESPOND TO **HVAC QUESTIONS**



In 1982, when the fitness industry was still in its infancy and “going to the club” meant golf, tennis, or swimming, OLC designed Racquet World at Inverness, Denver’s first full-service athletic club with aerobics rooms, swimming pools, racquetball courts, indoor tennis, running track, and weight machines. Thirty years and several hundred projects later, our firm remains the industry leader in health and fitness design. OLC’s portfolio of athletic and fitness club projects total more than 10 million square feet with a construction value over $1 billion. For most of our club fitness projects, our go-to mechanical engineer consulting partner is The Ballard Group. We are currently collaborating with them on several projects.

1. WHAT HEALTH CLUB HVAC/AIR FILTRATION ISSUES ARE MOST CONCERNING TO YOU RIGHT NOW?

Health club operators should review and adjust their HVAC systems to maximize the amount of outside air (OA) within the facility as soon as possible if they have not already done so. Many HVAC systems installed in the past 10 years have been heavily focused on energy efficiency. One energy conservation method commonly implemented is demand-controlled ventilation. This measures CO_2 in the space and reduces OA when the CO_2 generated from occupants is lower than the limits recommended by ASHRAE (American Society of Heating, Refrigerating and Air-Conditioning Engineers). This issue with this is CO_2 is not the only contaminant that can be present in the air, contaminants such as a virus can be generated by a single person and generally are not measurable. During the pandemic, we would recommend disabling any demand-controlled ventilation sequences to ensure OA ventilation is supplied to each room and quantity is not being reduced by a CO_2 control sequence. We would also recommend reviewing individual equipment capacities, if units were designed with any excess capacity it may be possible to increase the amount of OA supplied by the equipment. The higher the percentage of OA the better as this means less air from inside the building is being recirculated back into other areas of the facility.

2. WHAT QUESTIONS SHOULD HEALTH CLUB OPERATORS ASK THEIR HVAC/AIR FILTRATION SUPPLIERS?

In general, most commercial HVAC equipment is designed with only a single set of MERV 8 filtration media. Typical MERV 8 filter depths are 1”, 2”, and 4” with 2” being the most common. MERV 8 filters are relatively inexpensive—these are listed to capture 85% of particles from 3 micron to 10 microns in size. The next step up in filtration is typically the MERV 13 filter, which captures 50% of particles between 0.3 and 1 micron. Virus size is roughly 0.125 micron, MERV 8 and MERV 13 filters do not provide ratings for this size. Viruses are most effectively captured by HEPA filters (MERV 17 or better), which have been used for this application in hospital equipment for many years. The issue with HEPA filters is that the average commercial HVAC unit is not configured for their use.

On the other hand, hospital equipment is specifically designed to accommodate the economical use of HEPA filters. The equipment typically uses a MERV 8 pre-filter to capture larger particles then a HEPA final filter to handle the smaller-sized contaminates such as viruses. This approach prevents the expensive HEPA filters from quickly being clogged with large dust and debris commonly found in outside air.

Most health clubs do not have hospital-grade equipment. The commercial HVAC equipment that for health clubs typically use are not designed with space for large HEPA final filter rack and most single filter rack unit depths are not wide enough to install a HEPA filter. Even if they did, HEPA filters require significantly more fan pressure, which most equipment cannot accommodate.

Therefore, questions that operators should ask include:

***MERV 13 filter questions** to ask if the facility equipment currently uses 1", 2", or 4" MERV 8 filters and has no space to add a second set of higher efficiency filters and the desire is to upgrade to MERV 13 (or better) filters installed without pre-filters.*

- Is the MERV 13 filter at all effective in capturing virus contaminants?
- MERV 13 has a capture rate of 50% for particles down to 0.3 micron, however the typical virus contaminant is smaller, so is this worth the investment?
- How much additional static pressure does the unit supply fans need to accommodate with a MERV 13 filter in lieu of a MERV 8?
- Since MERV 13 filters will also capture smaller dust than a MERV 8, assume they will require a more frequent change out. How often do MERV 13 filters, if installed without a pre-filter, require changing?
- If the unit can accommodate additional pressure, should we consider a temporary pre-filter media installed over the OA intake to help limit the frequency of MERV 13 filter changing?
- How much is a MERV 13 filter cost vs. a standard MERV 8 filter?

***HEPA filter questions** to ask if a facility operator believes HEPA filters (MERV 17 or better) would be the most effective way to capture virus contaminants but current equipment is standard commercial construction with only space for a single set of 2" filters and fans have no additional capacity for additional static pressure from upgraded filters.*

- Are there any available options for a retrofit of existing equipment to be able to install HEPA filters?
- What is the cost for replacing a standard commercial RTUs/AHUs with one that can accommodate both a MERV 8 pre-filter and a HEPA final filter?

3. SHOULD CLUB OPERATORS OPEN WINDOWS OR USE OTHER METHODS TO INCREASE FRESH AIR?

If equipment cannot be retrofitted with HEPA filters, we would recommend increasing OA as much as possible given the existing equipment capacities. This will lower the amount of return air that is recirculated in the building. However, this can increase building energy usage significantly. At a minimum, we recommend disabling demand-controlled ventilation sequences as some of these may reduce the system OA to 0% with all air in the building being recirculated.

4. WHAT IS IMPORTANT TO KNOW ABOUT HVAC FILTERS AND MINIMUM EFFICIENCY REPORTING VALUE (MERV) RATING?

- Virus size is believed to be around 0.125 micron, even MERV 13 filters are only rated to capture particles down to 0.3 micron. Therefore, HEPA filters (MERV 17 or better) are typically recommended if the intent is to capture virus contaminants.
- Typically, as the capture efficiency of a filter increases, it requires more static pressure to move air through the filter. Usually, commercial HVAC equipment is designed for only MERV 8 filters, therefore before upgrading, verify if the existing fan systems can accommodate the additional pressure.
- The higher the capture efficiency the more frequently the filters will typically require changing. Upgrading equipment so it can accommodate MERV 8 pre-filters and either MERV 13 or HEPA final filters is typically recommended if high filtration rates are required/desired. Otherwise the expensive MERV 13/HEPA filters will likely require frequent changing.

5. SHOULD CLUBS CONSIDER PROACTIVE MITIGATION MEASURES SUCH AS UV-C OR REVERSE IONIZATION AIR PURIFICATION SYSTEMS?

We would suggest reviewing all options, it is possible that a UV-C or reverse ionization system would help in reducing indoor contaminants such as a virus. However, specific system types should be reviewed for effectiveness against a virus prior to implementation.

6. SHOULD CLUB OPERATORS LET MEMBERS KNOW THE STEPS THEY HAVE TAKEN REGARDING HVAC? IF YES, HOW SHOULD THEY GO ABOUT DOING SO?

Absolutely. There are several reasons for this:

- Clear communication of steps taken to protect the member can only enhance the credibility of the operation.
- Awareness of issues surrounding air quality and the club's operational response will help members understand why things are not the way they used to be. These issues may include a hotter/colder air temperature in the room, increased discomfort from higher velocity of air (makes one feel cooler), or the limitations on use of specific rooms.
- Knowing that the health club's operator is addressing air quality concerns scientifically and methodically will make it more likely that a member will feel more assured about coming to the facility and continuing their relationship with the club.

7. IS THERE ANYTHING ELSE IMPORTANT TO MENTION?

Air distribution patterns inside individual rooms are also important. Filters and OA exchange rates do not do anything to limit spread in a single room. Large conference rooms, meeting rooms, aerobics, or group X rooms with large groups of people can be problematic in this regard. Many HVAC systems supply air at relatively low velocities uniformly throughout the space, however, in many cases all the return air intakes are installed on one or two sides of the room. Therefore, if you are sitting near the RA intakes, the contaminates from all users may be passing by in the air you are breathing. Completely correcting these air distributions concerns can be very difficult, but it may be possible to improve, pending airflow configurations, air device types, and air quantity available.

To mitigate these concerns, consider holding any activity outside that can be done so. Alternatively, try to create the most outdoor-like air environment inside that you can. Suggestion for activity rooms or meeting rooms, especially those with large groups:

- Open windows or doors to the outside.
- Open internal doors to dilute the room air with adjacent spaces.
- Increase air circulation and dispersal by adding fans in the room, preferably directed away from people (e.g., toward windows or doors).
- Alternate every classes/meeting with a period of time when the room is empty, allowing the HVAC system to filter and replace return air from the prior event. Down time required will vary based on the size of the room, number of people and the HVAC system capability itself.

Please note that the above does not apply to rooms with pools. Natatoriums are typically pressured negatively with respect to the rest of the facility. Opening doors or windows in natatoriums will adversely affect not only the air in the pool, but potentially be problematic for the rest of the facility.

ABOUT OLC (OHLSON LAVOIE CORPORATION)

OLC is an international architectural firm, founded in 1961 and headquartered in Denver, CO with offices in Columbus, OH, and Orlando, FL in the U.S., as well as in Tokyo, Japan and Cairo, Egypt. We are committed, enthusiastic, and driven to deliver stellar architecture, interior design, and aquatic design. For the past 34 years, we have focused on athletic, fitness and wellness facilities, including athletic/sports clubs, commercial fitness centers, medically based wellness centers, recreation centers, spas, and a broad range of aquatic projects.

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ABOUT THE BALLARD GROUP, INC. (TBG)

The Ballard Group was founded in 1978 to provide quality mechanical engineering services with specific emphasis on designing heating, ventilation, air conditioning, plumbing, fire protection, and medical gas systems. We maintain two offices: our main office in Lakewood, a western suburb of Denver, and a branch office in Fort Collins, in northern Colorado.

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