



## AN ARISTA TECHNICAL ARTICLE

### IMPROVING AN IMPERFECT WORLD

Mitigating Office Temperature Extremes



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## INTRODUCTION

If there's one thing we can all agree on, it's that no two people sharing an office can agree on the ideal temperature. Some get angrier and more impatient as they get hotter under the collar, and others complain of frostbite at any temperature below tropical. Where's the room for compromise?

Not surprisingly, complaints about temperature control and extremes are the number one grievance expressed by office workers, according to the International Facility Management Association.

As an office or facilities manager, or building owner, you've no doubt heard your share of complaints. The question is: What, if anything, can you do about them? And what will it cost?

## ALL COMFORT IS NOT CREATED EQUAL

The good news: It's entirely possible and equally affordable to make building

temperatures more comfortable and worker friendly; typically, simple updates will do the job.

The bad news: No two people are alike. The problem is that the way people experience temperature depends on a range of factors, including body type, clothing, activity level and proximity to other people and to vents, computers and windows, as well as individual preferences and expectations.

Disagreements that develop can quickly erupt into full-scale "warmageddon" if management doesn't act effectively to balance the comfort requirements of workers. More broadly, uncomfortable working conditions are proven to have a significant impact on worker productivity; contributing to a lack of focus that can interrupt workflow and cooperation between team members.

If you're hearing complaints about temperature extremes one way or the other, there are steps you can take to improve the situation without investing a bundle.



“Complaints of the temperature being too hot or too cold always top the list (of complaints), often alternating from year to year.” - TEMPERATURE WARS: SAVINGS VS. COMFORT

## MEASURING COSTS AGAINST COMPLAINTS

Your HVAC system is made up of hundreds of component parts and hundreds, if not thousands, of feet of ductwork and venting, any part of which could be contributing to temperature extremes. The fact is, it's not possible to estimate the investment needed to solve the issue without a thorough testing of the system by experienced professionals. In most cases, however, you can be assured the costs will be far less than you'd expect, assuming that your system has been properly maintained by your HVAC service contractor.

A growing body of research shows that the right indoor environment can improve workforce output as well as the experience of customers or guests, directly resulting in savings for your business, your property or your building tenants. When you take into consideration all the benefits that arise from a more comfortable environment — from more productive workers to more satisfied customers — it's not unrealistic that the savings and revenue generated by a more comfortable workplace could cover the cost of any system updates.

So what can be done to amend an existing HVAC system, making it more responsive to the comfort needs of your building's tenants? Plenty...and none of it is budget breaking.

## 10 STEPS TO IMPROVING INTERNAL AIR FLOW AND OCCUPANT COMFORT

According to the International Facility Management Association, building managers and facility owners should consider these 10 common-sense steps when trying to manage the issue of temperature variance:

- 1. Update or replace outmoded HVAC components or systems.** If your HVAC service provider has been proactive and recommended necessary upgrades and system modifications all along, this shouldn't be an issue. If they haven't, we highly recommend that you have an independent HVAC professional take a look at your system and its components to see if simple updates will help improve air flow.
- 2. Verify that building automation system is working as designed.** Settings may have become obsolete due to office reconfigurations or other changes to the building's layout. A review of the system controls may reveal adjustments that will help your equipment run smarter and smoother.
- 3. Clean ducts and vents.** Maintenance shouldn't end at the point where heated or cooled air leaves the central system. Ducts, filters and vents can become clogged with dust, grime and hair, reducing efficiency and airflow.
- 4. Install more efficient light fixtures that reflect less heat.** Cool light is best to reduce the chance that lighting is warming thermostat controls and, in turn, chilling workers.
- 5. Modify ductwork.** As building occupants come and go and staff changes are made, new office and cubicle layouts may require changes to the positioning of ductwork.



**RESEARCH SHOWS THAT COMFORTABLE INDOOR TEMPERATURES CONTRIBUTE MEASURABLY TO HEALTHIER, MORE PRODUCTIVE ENVIRONMENTS FOR EMPLOYEES, TENANTS OR CUSTOMERS. THIS MANIFESTS ITSELF IN A NUMBER OF WAYS, INCLUDING: BETTER WORKER PERFORMANCE; COST SAVINGS IN THE FORM OF FEWER EMPLOYEE ABSENCES; ENHANCED CONCENTRATION; HIGHER EMPLOYEE RETENTION RATES; AND IMPROVED CUSTOMER SATISFACTION, TO NAME JUST A FEW.**

According to Contracting Business, less than one in 10 duct systems are installed well enough to perform above 80% of the equipment manufacturer's rated capacity. Most modifications to ductwork can be done with no interruptions to worker productivity.

- 6. Install new window shades.** Whether to retain heat in the winter, shade the sun's rays in the summer, or provide maximum UV blockage, energy-efficient window coverings can help cut energy costs and improve comfort levels throughout the workplace.
- 7. Add window film to improve thermal properties.** Solar and decorative window films can provide sun control and UV protection, reduce hot spots, and provide window tinting and privacy while increasing energy savings. And, unlike shades, window film doesn't block the view.
- 8. Retro-commission the building.** Undertaking an energy audit and retro-commissioning will give you a much more robust understanding of your building performance, and how to improve its HVAC and mechanical functioning to improve comfort and save money. You may even qualify for tax credits, so be sure to ask your accountant!

- 9. Provide more local control of thermostats to occupants.** The more control you're able to give to workers, the fewer complaints you'll have regarding temperature variables. Even limited control, such as 5° in either direction, can help reduce complaints.
- 10. Consider environmentally friendly initiatives.** Green roofs, heat recovery and solar water heating can improve comfort and may even provide tax breaks. Again, ask your accountant about any tax benefits to offset costs.

## **BOTTOM LINE IMPACT: WARMER IS BETTER FOR PRODUCTIVITY**

In an article published in The New York Times, research by Cornell University professor Alan Hedge revealed that employees who are cold tend to work less efficiently. He measured computer keystrokes performed by office workers in temperatures ranging from 68 to 85° Fahrenheit. "At 85°, they're typing twice as much in a minute as they are at 68°," says Hedge. Colder workers also made a greater percentage of mistakes.

Temperatures in most buildings are usually set between 70 and 74°, depending on the

time of year, Hedge said. But his studies have shown that a temperature between 72 and 79° is optimal for worker productivity and comfort, assuming a reasonably flexible dress code.

## BEATING THE BATTLE OF THE SEXES

Typically, women feel the cold more acutely than men, while men roast when the temperature nears what's deemed comfortable for many women.

Indeed, in some office situations, telling a co-worker to "put on a sweater"(i.e. stop complaining) equates to fighting words. Obviously, the clothing choices people make during the cool and warm months play an enormous role in how comfortable they are in the office, and the number of complaints that arise from insufficient warmth or cooling could be abated somewhat with smarter clothing choices.

But current fashion differences between the sexes aren't quite so similar. In fact, a female

office worker in 2014 may have a Clo that's half of her male counterpart. Keep in mind as employees dress for summer, they are often ill equipped for the interior air-conditioned temperature. That's why it's advisable to suggest keeping supplemental clothing on hand, such as a light sweater or wrap. Of all of the steps that can be taken to balance temperature variables in the office, few are as easy to achieve or as cost negligible.

## TAKE CONTROL OF DO-IT-YOURSELFERS

If building management doesn't take steps to manage extreme temperatures, workers often take it upon themselves to modify their workspaces with gadgets such as personal fans, stand-alone air conditioning units and under-desk heaters. Some will block or redirect vents, tie ribbons to them to show you how the air is blowing on their head, or tamper with thermostats.

Outside of the fans, none of these do-it-yourself solutions are acceptable. Personal heaters are not only unsafe because they are a fire hazard; they can lead to small power outages requiring maintenance staff to continually reset breakers. Some people will also tape cardboard to diffusers to redirect the air away from them, which could influence thermostat settings. Complaints often come from employees who sit close to windows, so the obvious answer is to ask them to adjust their blinds if they are too hot or cold.

## SYSTEM REDESIGN: AN ECONOMICAL SOLUTION

When you consider that nearly 40% of HVAC systems are between 16-30 years old, it's easy to see how, if not properly maintained or updated to meet office configuration changes, older systems can pose their own sets of problems for workers beyond just heating and cooling variations.

At the same time, most modern office

### DO YOU KNOW YOUR CLO?

While few have ever heard of it outside the field of thermal research, "Clo" is the standard measure of body insulation used by building managers and clothing manufacturers alike.

"Clo" is a complex equation based on the insulation necessary to maintain a comfortable skin temperature of 92° in a room-temperature environment. A Clo of 0 represents the naked body. When the scale was developed in 1941, wardrobes for both men and women wore were more uniform and traditional. Men and women wore similar amounts of clothing, skirts were longer, blazers and sweaters were more common, and so it was a bit easier to achieve a modicum of similarity between the sexes when it came to temperature control.

Most modern office buildings have a one-size-fits-all design that can't possibly accommodate the variables associated with the age and condition of a system.

buildings have a one-size-fits-all design that can't possibly accommodate all these variables.

A critical first step before redesigning is to test the operating condition of the existing system. System values that should be tested include total external static pressure; system component pressure drops; fan, system and grille register airflow; as well as system temperatures. Your HVAC service provider should compare this data against the equipment manufacturer's published engineering data to evaluate existing system performance.

## GUIDE TO A SUCCESSFUL SYSTEM



## REDESIGN

If testing shows a system redesign is in order, here are eight steps you can take to help ensure success.

- 1. Assess system performance before redesign.** Many performance-reducing defects can only be discovered through testing. Your HVAC service provider
- 2. Create a floor plan.** Your contractor should take measurements of each room and create a floor plan. Key elements of each room that may affect airflow and heat loss or gain should be recorded, gathering all of the data needed to compute load calculations.
- 3. Check static pressure capacity and fan size.** Knowing the static pressure profile of your system will help you monitor component costs. It will also help verify if your fan capacity is sufficient to do the job required after redesign and help determine the necessary duct sizing.
- 4. Measure airflow to workspaces.** How much air does each office and conference area need? The required system airflow is divided among the rooms of the office space and will help you interpret air balancing hood readings.
- 5. Measure system air properties.** To learn how the system is performing, your HVAC service provider should measure the system air properties and combine those

will measure system static pressures, temperatures, airflow, fan speed and electrical properties. These measurements are fed into a series of efficiency calculations during the performance assessment process. The usual suspects that contribute to poor system performance include: duct temperature loss, duct leakage, excessive restrictions that increase static pressure, decreased system capacity, poor airflow distribution and refrigerant and combustion issues.



Your HVAC service provider should compare system value data against the equipment manufacturer's published engineering data to evaluate existing system performance.

readings with redesign principles based on the manufacturer's engineering data. The effectiveness of a redesign hinges on your HVAC service provider's ability to interpret existing readings and apply corrective measures. For example:

- System components may have excessive pressure drop and have to be removed or replaced.
- Additional insulation may be required if temperature loss through the duct system exceeds three degrees.
- Temperature changes at the supply registers may indicate leakage at the boot that will need to be sealed.
- A significant change in return air temperature may reveal a return leak that should be tightened up.
- Missing or doubled airflow can indicate that ducts need to be replaced or dampers installed.
- A thorough test of the system will pinpoint defects that a redesign can correct, saving you money through efficiency improvements and stabilizing office temperature levels.

**6. Evaluate duct system design.** Lay out a duct schematic according to local code requirements and building allowances, or just focus on the ducts that aren't performing properly. Keep in mind the room available for duct renovation and the type of duct material used. When walls get moved around to accommodate expansion or new tenants, it's often easy to re-route ductwork to more effectively heat or cool workers in the new office space.

**7. Test the system.** Testing will verify each part of the redesign and confirm system performance.

**8. Check ductwork size.** System assessment often reveals undersized ducting. Sometimes increasing or adding duct capacity is a universal solution. On the return side and supply side, adding or increasing duct capacity can increase system performance and enhance individual room comfort. Redesigning a duct system in the field using live system measurements will help your HVAC service provider avoid the hazards of just duct sealing systems without adding badly needed additional duct capacity.

So if your HVAC system isn't operating as it was designed to, that doesn't necessarily mean a huge price tag. Small changes are often the key to improving temperature variances. Check with your service provider for minor adjustments that can pay big dividends, now and into the future.



## **ABOUT ARISTA AIR CONDITIONING CORP.**

Whether you're responsible for the installation of a new HVAC system or inherited legacy equipment, Arista has the experience to service and maintain any system throughout its life-cycle. Across the tri-state area, we're recognized as one of the region's most respected and referred HVAC experts. When you purchase a preventive maintenance service agreement from Arista, you're backed by an industry leader with that has earned its reputation through decades of trustworthy business conduct and quality service.

Peace of mind at a fair price

Your account is managed by a senior Arista technician and backed by an expert staff of over 160 highly trained professionals. Arista boasts a comprehensive program of continuous staff training and professional development on state-of-the-art practices and processes.

Arista clients also enjoy these benefits:

- Quick-to-respond, accessible workforce and a fleet of 100+ vehicles
- 24/7 emergency standby service
- 30,000 sq. ft. corporate warehouse facility stocked with over 55,000 parts

- Industry recognition as the only NY state company to earn both the prestigious MSCA STAR and GreenStar designations
- LEED Accredited Professionals to assist in making smarter HVAC choices

### **Questions? Call Arista today.**

We hope you've found this guide to be a handy reference as you evaluate the types of service contracts available to you.

We invite you to call us for a quote on your equipment purchase or service needs. We think you'll agree that hearing what we have to say will be one of the best decisions you make in researching HVAC maintenance contracts. Reach an Arista HVAC specialist today at 718-937-4001 or email [info@aristair.com](mailto:info@aristair.com).

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