WHITE PAPER

USING DRICALC® TO CONFIDENTLY AND EASILY SPECIFY AND SELECT HUMIDIFICATION SYSTEMS

EXECUTIVE SUMMARY

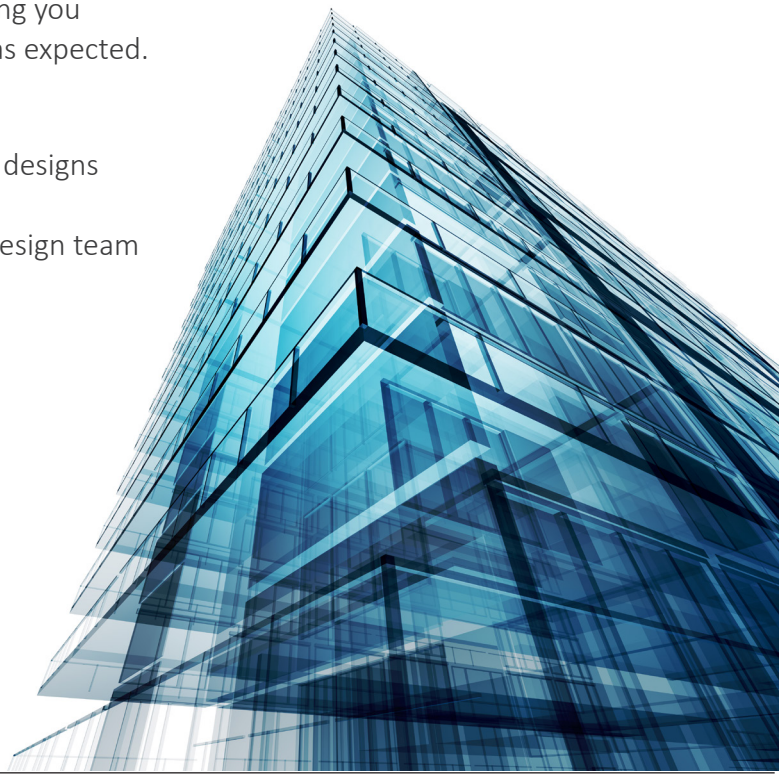
Humidification is an integral part of many of today's HVAC systems. The fundamental principles of humidification are well documented. Still, the intricacies of how humidification systems work within a complex HVAC system and the vast array of humidification options can be daunting even for a seasoned HVAC engineer. DriSteem is a world leader with over 60 years of expertise in designing and manufacturing humidification systems to meet demanding and unique requirements.

As a way of supporting our mission to provide customers with exceptional service and superior products, DriSteem has developed DriCalc® Sizing and Selection software to make it easy for engineers to select a humidification system that meets their needs.

Engineers face many challenges when designing HVAC systems: demanding customers, tight schedules, limited budgets, competing requirements, new and changing technologies, and meeting rigorous standards. DriSteem understands these challenges and is committed to partnering with our customers to make the process of selecting the best humidification system as easy as possible, while giving you confidence that the system you select will perform as expected.

There are four main sections in this white paper:

1. Introduction to incorporating humidification into designs
2. Overview of what the DriCalc software offers
3. Benefits that the DriCalc software brings to the design team
4. Accessibility and training options



INTRODUCTION TO INCORPORATING HUMIDIFICATION INTO DESIGNS

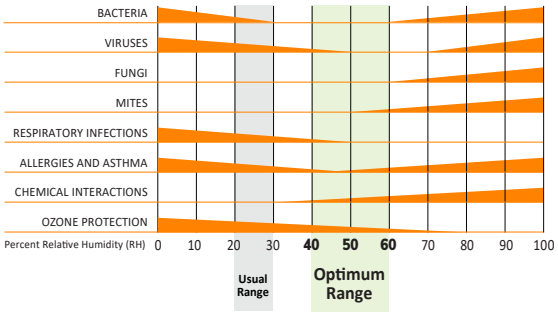
Importance of Humidification in Building Design

Proper humidification is extremely important for many applications and must be considered up front during the building design process. Factors to consider include the intent (humidification or cooling), the humidification load, available energy sources, the quality of the supplied water, where the moisture will be dispersed, and the level and type of controls needed.

Failure to consider all factors may result in a system that operates inefficiently and doesn't meet the intended requirements, or cause unintended consequences due to poorly managed moisture. With a good design, properly controlled humidification can promote health and safety, improve productivity, extend the life of materials, and enhance occupant satisfaction.

Here are some common uses of humidification:

- **Indoor Air Quality**: Studies have shown that the optimum range for relative humidity (RH) is between 40-60%. Bacteria and viruses thrive in dry air where the relative humidity is less than 40%. Keeping the relative humidity under 60% hinders the development of fungi, mites, chemical interactions, and ozone production. Proper humidification can reduce occurrences of allergic rhinitis, respiratory infections, and asthma, as well as absenteeism.



- **Material Preservation:** Many building materials, finishes, furnishings, and artifacts are hygroscopic, meaning they absorb, retain, and release moisture. Fluctuating humidity can cause damage to these sensitive materials due to cyclical contraction and expansion as the moisture content changes. Maintaining consistent relative humidity levels helps to preserve these materials and extend their life.

- **Process Control:** Many manufacturing processes can be impacted by the relative humidity. Maintaining proper humidification can keep production rates high, improve product quality, and reduce scrap. Low relative humidity can also cause problems with static electricity, which can damage electrical components, ignite combustible materials, and cause dust particles to adhere to sensitive materials.

- **Improves Comfort for Building Occupants:** The human body is highly sensitive to relative humidity levels. As a body's moisture migrates (evaporates) to areas of lower relative humidity, it becomes cooled. Raising the relative humidity level in a room slows the evaporation rate and will make the room feel warmer. Controlling relative humidity levels can impact the comfort level of the occupants.

- **Promotes or Inhibits Biological Growth:** Many plants and biological organisms are affected by the relative humidity level of their environment. Controlling the relative humidity level can either promote biological growth or inhibit it.

Critical Design Considerations

Intent: When designing a humidification system, it's important to consider the intent. If the purpose of the humidification is to provide cooling or add moisture without adding heat, an evaporative (adiabatic) humidifier is appropriate. High-pressure atomization humidifiers utilize evaporation to add moisture to the air. The alternative to an evaporative humidifier is to use an isothermal humidifier. Gas, electric, and steam-powered isothermal humidifiers add moisture to the air by boiling water to generate steam, which then evaporates quickly.

EVAPORATIVE (ADIABATIC) HUMIDIFIERS:

Use the heat in the air to evaporate water into the ductwork or directly into the space.

ISOTHERMAL (STEAM) HUMIDIFIERS:

Work by boiling water inside the humidifier tank and distributing it into the ductwork through a steam manifold or directly into the space.

Load: For any system, it's important to determine the required humidification load so the proper size of the equipment can be selected. The risks of undersizing or oversizing must also be considered, as this will impact the cost and performance of the humidification system. Consider how outside air enters the building, whether through natural ventilation, mechanical equipment, or an economizer, which will vary the amount of outside air and impact the load.

The humidification load for a building varies depending on many factors.

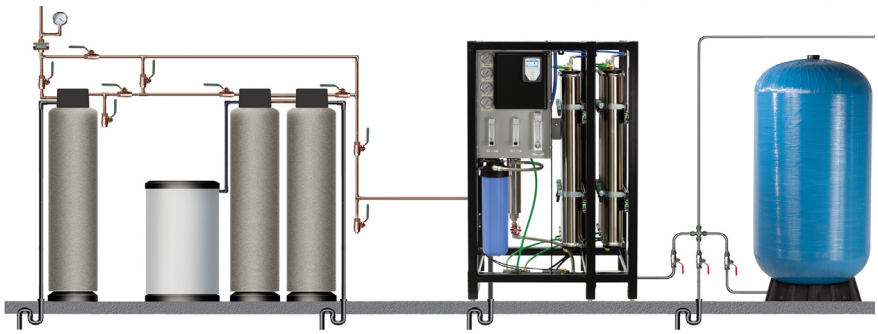
Energy Source: Isothermal humidifiers can use electricity, natural gas, or steam as the energy source. Adiabatic systems use electricity. The most appropriate choice will depend on the cost of the energy source at the location where the humidifier will be installed, the humidification load, the availability of the energy source, the budget available, and whether rebates are available. Electric-powered isothermal systems are generally simpler to install than gas- or steam-powered systems, but the cost of operating them will be higher. A steam-to-steam system is a good option if a building already has steam available.

Isothermal humidifiers use electricity, natural gas or steam as an energy source.

Water: One thing that all humidification systems have in common is water use. The water quality can impact the performance, level of control, maintenance, and overall cost of any humidification system. DriSteem's humidifiers can operate with potable (tap) water, softened water, Reverse Osmosis (RO) water, or Deionized (DI) water.

Humidifiers use potable (tap) water, softened water, Reverse Osmosis (RO) water, or Deionized (DI) water.

Factors that should be considered when selecting a water source include the required up-time, the location where the humidifier will be installed, the level of control needed, and the budget. If a high up-time is required or the humidifier is in a hard-to-access location, softened or RO/DI water should be used. DriSteem offers dechlorinators, water softeners, RO systems, and storage tanks, which can be selected from the DriCalc software individually or as part of a complete system.



DriSteem water treatment system with dechlorinator, water softener, reverse osmosis system, and storage tank.

Dispersion: There are many options to disperse the moisture generated by a DriSteem humidifier. It can be dispersed into an Air Handling Unit (AHU), a duct, or open spaces. The placement of the dispersion system is very important. Dispersion systems can be located in the incoming air, makeup air, supply air, or within the humidified space. Factors to consider when selecting the location include available absorption distance, location of downstream components (i.e., elbows, fans, vanes, and filters), and construction materials.

DriSteem Ultra-sorb® XV steam dispersion panel.

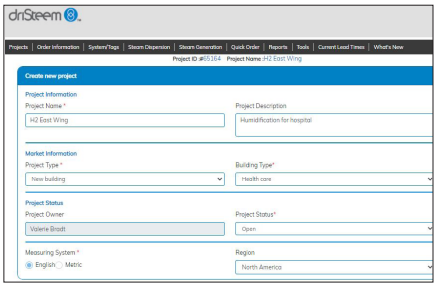
Control and Monitoring: Finally, it's also important to consider the level of humidity control needed and the sensors required for safe operation. Controllability varies based on technology and configuration. Sensors for detecting high humidity or low airflow are useful for ensuring safe operation. Both can shut down a humidifier to prevent a build-up of excessive moisture. Setback setpoint sensors can also be used to monitor the relative humidity in cold weather conditions to prevent frost from building up on cold surfaces such as windows. Most of DriSteem's humidification systems come with Vapor-logic® controllers. Integrating with other building control systems such as BACnet, Modbus, and LonTalk is also possible. All of these options can be selected using the DriCalc selection software.

Vapor-logic controller for DriSteem humidification systems.

OVERVIEW OF WHAT DRICALC PROVIDES

Design and Selection of Humidification Systems

There are many steps involved in the process of properly designing an effective and efficient humidification system. As with any engineering project, these steps include proper planning, defining requirements, performing detailed calculations, identifying feasible options, weighing costs and benefits, documenting design outputs, performing necessary validation, and generating a documentation package for the customer. Doing this all manually can be a difficult and time-consuming process.

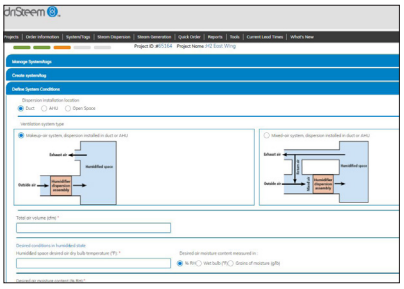


New project page in DriCalc Sizing and Selection software.

To simplify this process, DriSteem's web-based DriCalc Sizing and Selection software guides an engineer through the entire process, which can be broken down into four major steps:

1. **Plan**
2. **Define**
3. **Sizing & Selection**
4. **Reports**

Plan: As with any design, the first step is to plan things out. This requires some work up front to gather information about the building and humidification requirements. Then, a project can be created using the DriCalc selection software. Each project can have an unlimited number of individual systems. These systems can be isothermal humidifiers, evaporative (adiabatic) humidifiers, steam dispersion tubes or panels, water treatment systems, and more.



New system page in DriCalc Sizing and Selection software.

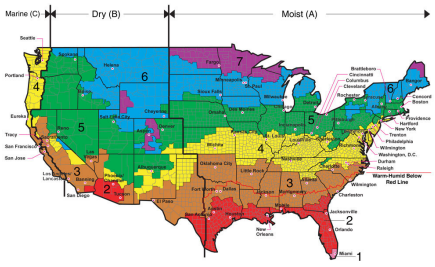
Define: For each system that is part of the project, the next step is to define the system conditions and application requirements. The DriCalc tool allows the use of ASHRAE weather data to aid in determining the appropriate humidification load. The type of information DriCalc asks for will depend on the type of system being designed and may include the following:

Humidifiers

- Dispersion location
- Ventilation type
- Total air volume
- Temp & RH conditions
- Location details
- Airflow conditions
- Load
- Energy source
- Water type

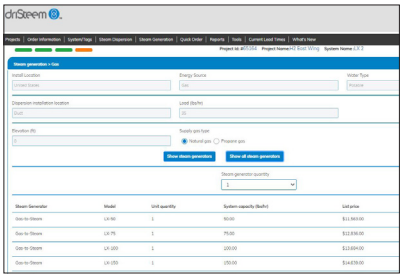
Water Treatment Systems

- System type
- Water source
- Water hardness
- Required capacity
- Min/max flowrates



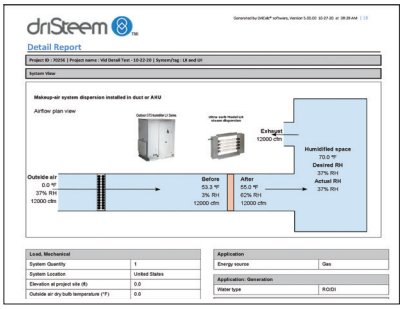
ASHRAE climate zone map for the United States.

Size & Select: During the third step, the software guides the selection of system hardware, including generation and dispersion systems for humidifiers or water treatment components for water systems. DriCalc will ask additional questions about the application to narrow down the possible options and recommend optional accessories that are appropriate for the previous selections. Engineers often will try different hardware configurations to optimize the design.



Steam generator selection page in DriCalc Sizing and Selection software.

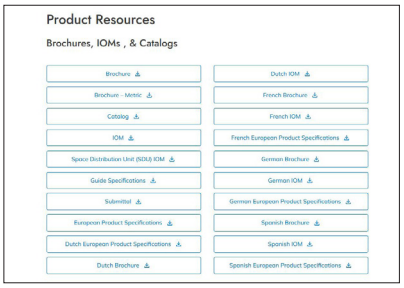
Reports: The final step in the process is to generate the project documentation. This can include Project Level Reports (System View, Schedules, and Detail Reports) as well as System Level Reports (System View, Detail Reports, Product Data Sheets, Guide Specifications, and Installation and Operation Manuals). This documentation can be included as part of the project submittals.



Detail report in DriCalc Sizing and Selection software.

Easy Access to the Most Current Product Literature

During the sizing and selection step, the DriCalc software will provide a list of equipment options. This list includes links to the product information for each option, allowing easy access to product specifications and other product resources. These product resources can be downloaded for the engineer's reference or included as part of the submittal package.

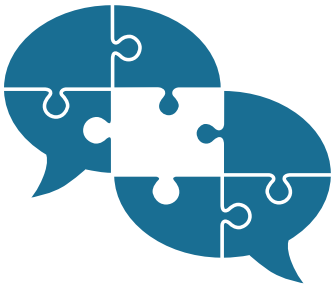


Links to product resources included in DriCalc Sizing and Selection software.

Collaborative Platform for Working with DriSteem Reps

DriSteem has a worldwide rep network trained to assist during the entire process, from project creation to the actual bid. DriCalc includes many features that facilitate this collaboration with the local rep. At any point during the project, an engineer can share a project with a DriSteem rep to review selections, provide feedback, share insights, and quote the project. This access can either be full or read-only.

Once shared, the rep can also copy projects, make changes, and share alternate selections without changing the original project. DriCalc also allows you to track Project Status (Open, Closed, Hold) and Project Phase (Design, Specify, Submit, Bid, Other). This helps keep everyone up to date on the project's progress.



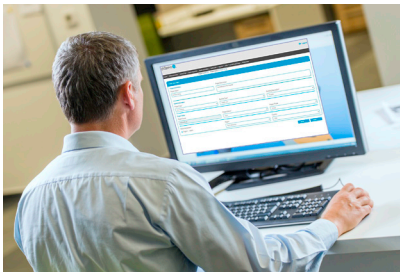
Share projects with a DriSteem rep to review selections, provide feedback, share insights, and to quote the project.

BENEFITS DRICALC BRINGS TO THE DESIGN TEAM

Increases In-house HVAC Component Design Capabilities

While humidification and water treatment are important elements of an HVAC system, they are not required for every system. Therefore, not every firm has developed a high level of expertise in humidification system design. With DriCalc, it's now possible to develop and support this expertise more easily in-house.

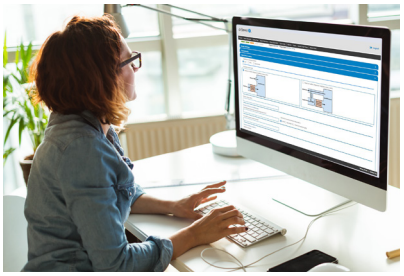
DriCalc puts DriSteem's extensive knowledge and expertise at an engineer's disposal, allowing firms to take on projects they could perhaps not bid on before. This can provide a strategic advantage in terms of company expertise and turn-around times.



Take on projects that your team was not able to bid on before with the DriCalc sizing and selection software.

Builds Humidification System Design Knowledge

The flexibility of a tool like DriCalc makes it easy for an engineer to design humidification and water treatment systems. The step-by-step process helps educate users by immediately displaying the impact of their selections. This makes for a great training tool and gives the user confidence that their selections will work. Engineers can easily share this knowledge with others within their organization, which helps build a foundation of knowledge that can be applied to future projects.



Use DriCalc's step-by-step process to design humidification and water treatment systems.

Provides a Humidification Load Double Check on In-house Calculations

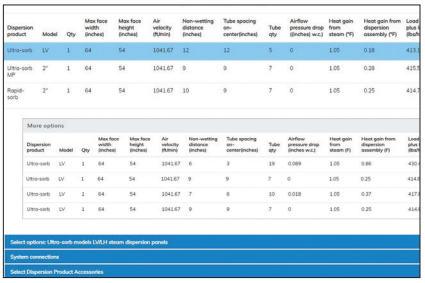
DriSteem's DriCalc software provides three options for coming up with a humidification load. These options include using the ASHRAE weather data and selecting the location, manually entering the location data and weather settings, bypassing the DriCalc calculated load, and just entering the humidification load directly. The DriCalc-generated loads will also require entering airflow conditions. Even though DriCalc is capable of calculating the required humidification load, DriSteem still encourages engineers to do their own calculations initially. Then, when working through a design in DriCalc, the engineer can compare the loads generated in DriCalc to their own calculations. This aids in the verification of the design.

Double check humidification load against in-house calculations with DriCalc.

Convenient Solution Comparisons

In most cases, it's possible to come up with multiple solutions to a given humidification requirement. These solutions can vary depending on the energy source used, the type of generation and dispersion equipment selected, and the entered system conditions. The best choice will depend on customer requirements, budget, the level of control needed, or other factors such as ease of installation or maintenance requirements.

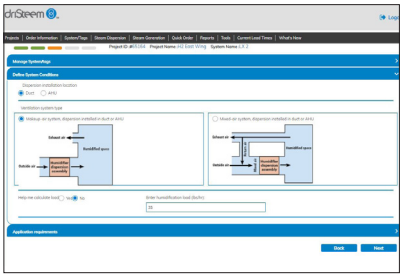
The DriCalc sizing and selection software allows for easy comparisons. Once a system is created, it can be copied and changed without altering the original system. Creating new systems with entirely different generation or dispersion options is also possible. The other variations can then be compared and evaluated before final selection.



Use DriSteem's DriCalc software to compare and evaluate systems before making a final selection.

Quickly Change Variables to See How They Affect System Design

It's not uncommon for HVAC system requirements to evolve over the life of a project. Once a project is created within DriCalc, it's easy to go back and make changes. DriCalc will reevaluate the selections made, and present new options based on the information entered. It's also a good practice to copy projects or systems prior to making changes in order to preserve the original sets of requirements.



It's easy to go back and make changes in DriCalc.

Speed Up Design Time by Reusing Previous System Designs

Even though DriCalc greatly simplifies the process of creating effective humidification systems, entering all of the information still takes time and effort.

Many engineers use the copy features within DriCalc to create template projects that can be reused. When a project similar to one that was previously created arises, save time by copying the project and/or systems and making minor modifications instead of re-entering everything from scratch.

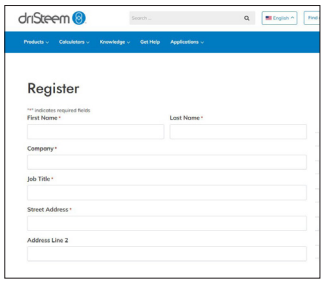
The project share features within DriCalc facilitate sharing templates with others, even if they are in different locations.

DriCalc streamlines the process of sizing and selecting humidification and water treatment systems.

ACCESSIBILITY AND TRAINING

Where to Get the DriCalc Sizing and Selection Software

To access DriCalc, visit the DriSteem website, navigate to the **Calculators** tab, and click on **DriCalc**. Fill out the form to Register for DriCalc and the request will be forwarded to the local DriSteem Rep for approval.



Register for DriCalc Sizing and Selection software at www.dristeem.com.

Training Resources

DriSteem has extensive resources available to help you learn more about DriCalc, humidification products, and water treatment systems. Check out **DriSteem.com** and our channels on **YouTube** and **Vimeo**. Follow us on **LinkedIn**, **Twitter**, and **Facebook**.

DriSteem regularly offers classroom-style training to engineers. Check with your local rep for availability in your area. The **Find A Rep** link at the top of the home page will help identify your nearest rep.

Video tutorials are also available within the DriCalc sizing and selection software.

DRISTEEM RESOURCES

- Industry Publications
- Case Studies
- White Papers
- Design Guides
- Articles
- Glossary
- Brochures
- Catalogs
- Product Resources
- Technical Support
- Video Library
- Installation and Operation Manuals
- Service Kit Manuals
- References Guides
- Handbooks
- Charts
- Flyers
- Cut Sheets
- Drawings
- Piping Instructions
- BIM Models

DRI-STEEM Corporation
a subsidiary of Research Products Corporation
DriSteem U.S. operations are
ISO 9001:2015 certified

U.S. Headquarters:
14949 Technology Drive
Eden Prairie, MN 55344
800-328-4447 or 952-949-2415
952-229-3200 (fax)

Europe, Middle East, Asia Pacific
+32 11 82 35 95
sales.europe@dristeem.com

Continuous product improvement is a policy of DriSteem; therefore, product features and specifications are subject to change without notice.

EXPECT QUALITY FROM THE INDUSTRY LEADER
Since 1965, DriSteem has been leading the industry with creative and reliable humidification solutions. DriSteem leads the industry with a Two-year Limited Warranty and optional extended warranty.

For more information:
www.dristeem.com
sales@dristeem.com

For the most recent product information visit our website:
www.dristeem.com