CURRENT CULTURE H2O®

LEADERS IN HYDROPONICS

Under Current Resource Guide

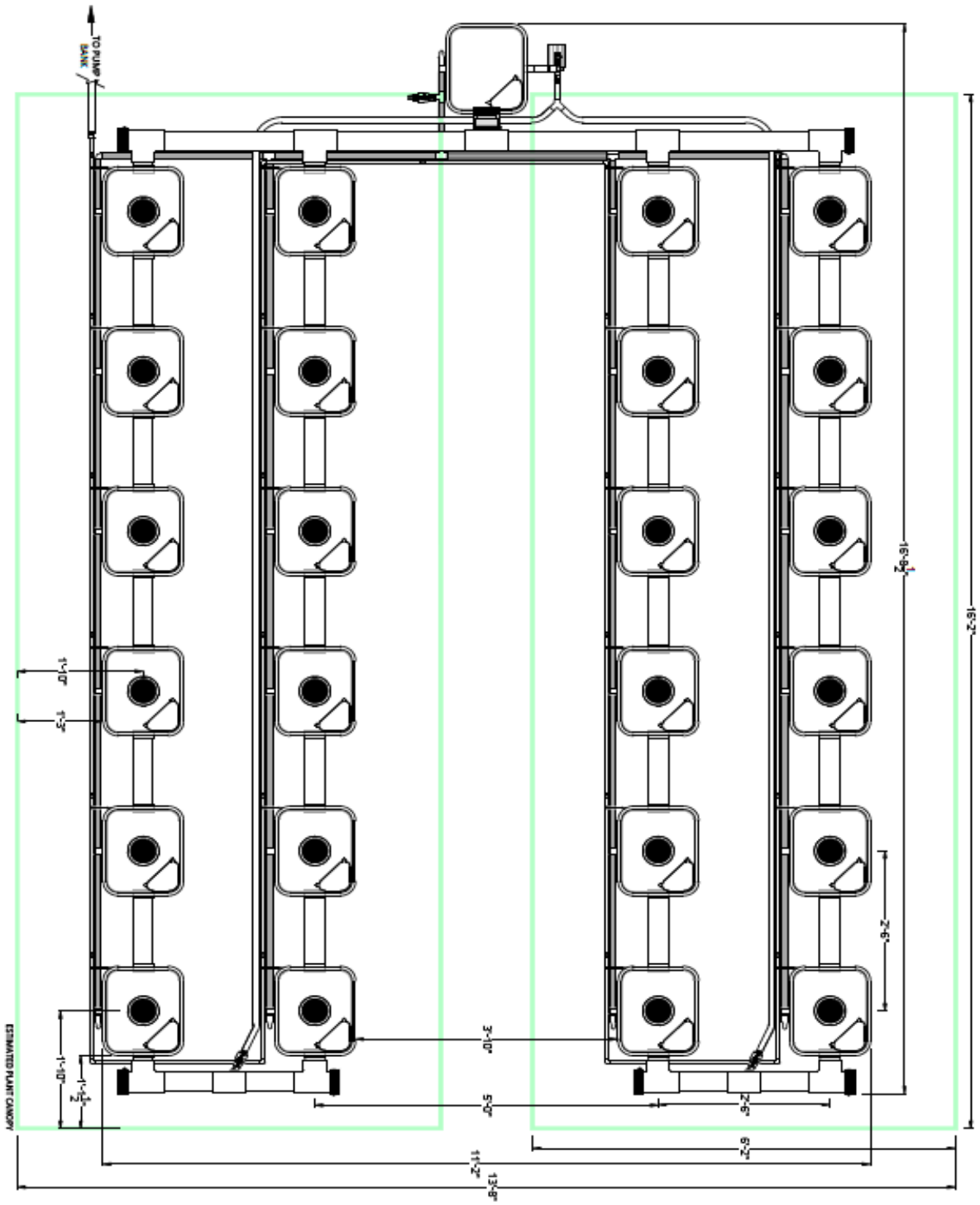


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CCH2O - GLOSSARY OF HYDROPONICS TERMS

Add Back Kit: "Adding Back" to a nutrient solution refers to topping up a system or reservoir with additional nutrients or crop feeding components between nutrient change outs. For example, as the EC lowers due to crop nutrient uptake. The Add Back Kit allows nutrients, additives, descaling solutions and pH buffers to be added back to the solution gradually to avoid shock using water flow from the circulation pump. The fitting uses siphoning and is adjustable. When not in use to add feeding components, the valve can be used to add aeration to nutrient

Aeration: Diffusing air into and or through nutrient solutions using air pumps, water pumps and nutrient solution circulation. There is a very direct relationship between crop health and aeration levels in the root zone, reservoir and cistern. Aeration creates an "aerobic" environment where a lack of aeration creates "anaerobic" conditions (favoring pathogens that are harmful to crops).

Aeroponics: A growing method often favored for plant propagation where bare rooted plants or cut stems supported by net pots or collars are intermittently or continuously misted or sprayed with nutrient solution in the root zone (rhizosphere). Aeroponics systems are best known for stimulating very rapid development in crops. Often considered to be an "advanced" growing method although present day technologies tend to be much friendlier than previous generations.

Air Pump Bank: An area or even entire room where multiple air pumps may be connected individually and/or in a series to provide healthy, pressurized air to supply manifolds and air stone for growth module or reservoir aeration. Air pump output may be controlled and measure by installing an Air Reg(s) to the system.

Air Stone: A porous and inert material constructed to receive pressurized air (air pump and manifold). When placed beneath the surface of water or nutrient solutions, the air is diffused into many small or micro bubbles that travel to the surface. For hydroponic use specialty air stones are preferred for the salinity and mildly acid nature of hydroponic nutrient solutions.

Air Flow Regulator: A tool or device used to standardize and calibrate aeration rates. Allows growers to adjust a measurable amount of aeration for hydroponics systems, reservoirs or cisterns, with readings provided as Inches of Water. Additionally, an air flow regulator extends the service life of air and water pumps while reducing the potential for excessive aeration.

Boneless Under Current System: When an UnderCurrent system is supplied with the necessary Spin Tight fittings to plumb the modules supporting net pots or collars together while the installer supplies the piping cut to desired lengths for customized spacing in grow floor plans.

CCH2O Lid: The rigid and sturdy covering for a single growth module that supports net pot(s) for crops or as a covering for an Epicenter. CCH2O lids also feature access ports, so roots may be inspected without raising lids in order to see.

Chiller: Typically refers to a reservoir chiller. A reservoir chiller may be gas charged or uses heat exchangers to help keep hydroponic nutrient solutions at optimal temperatures in warmer growing environments. There are many different types and applications for reservoir chillers. Keeping reservoirs at optimal temperatures helps potentiate dissolved oxygen levels for roots while mitigating potential issues with root pathogens.

CIP (Clean In Place): Grow room management techniques and practices that allow thorough and effective sanitation and cleaning of growing equipment, systems, surfaces, etc. without necessitating disassembly to save time. CIP practices help improve crop turn over times and save labor costs.

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Cloning: In the plant world, this refers to the asexual propagation of plants, i.e. producing new plants without seed. Typically performed by cutting shoots from carefully selected plants in a healthy vegetative stage of growth and placing the cut stems in a system and environment where they may develop roots. Cloned plants will share all the same genetic characteristics as the donor or Mother Plant, for example finishing at the same time and sharing the same harvest qualities from plant to plant.

Cloning Collars: Typically a circular disc of foam like material that can open and close for use in supporting cut plant stems to develop roots in cloning or propagation systems.

Cold-water loop: Supply (cold) and Return (warm) water plumbing strategy for chilling multiple hydroponics systems with centralized chiller and heat exchangers.

Crop Steering: Crop Steering is typically implemented in Drain To Waste, drip applications, involving the micro-management of irrigation cycles, sequencing intervals, dry back events, etc. The approach requires extensive instrumentation, automation and attention to detail. Though capable of producing strong results, the method is not user friendly and not well adapted to a broader cultivator base.

Crop Cruising: Practiced primarily in RWC (Recirculating Water Culture) applications, "crop cruising" involves creating a stable, suitable condition for crop growth, with minimal emphasis on micromanaging conditional parameters.

Typically with "crop cruising", target parameter differential is wider ranging and less specific than "crop steering" applications. This broadened parameter requires less manipulation, allowing growing conditions to stabilize.

Unlike "crop steering" which requires extensive micro management of irrigation practices, such as calculating dry backs, shot frequency and duration, run off EC, etc., "crop cruising" is relatively easy and much less thought intensive.

Simply put, "crop cruising" requires much less concern and intervention, making it well suited for today's busy lifestyle.

Crop Steering = More worry, less time.
Crop Cruising = More time, less worry.

Cultured Solutions Nutrients: Crystal clear nutrients for high performance crops available as Dutch Style A&B base nutrients, Bud Booster additives, and a CocoCal supplement. UCRoots and ClearLine are root zone enhancers that reduce scale and biofilms. These complete and 100% soluble formulations are made to be the cleanest in the industry.

Deep Water Culture (DWC): A foundational hydroponic growing method still widely used and adapted. Bare plant roots grow into a depth of aerated nutrient solution. Little or no growing media is typically used and plants are often supported in the system with a net pot or neoprene collars. The UC Solo System is a popular example of DWC systems.

Delivery Manifold: A pipe or tubing assembly designed to deliver aerated nutrient solution to the EPIcenter via a Return Pump following the Return Manifold.

Descaling, Descaler Additives: Crop safe nutrient additives such as Cultured Solutions UC Roots or ClearLine that are effective in reducing nutrient salt accumulation and biofilms in irrigation lines, growing surfaces and root systems. Additionally these additives, when used as directed, will help maintain healthy ORP (oxidation reduction potential) values in reservoirs and hydroponic growing systems.

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DO (Dissolved Oxygen): The majority of plants people cultivate prefer aerobic conditions in the root zone, i.e. they thrive in the presence of oxygen at the roots. Nutrient solutions with elevated DO (dissolved oxygen) levels stimulate faster growth rates and bigger yields. Increasing DO levels significantly (as in aeroponics and RDWC systems) reduces the need for higher fertilizer levels as plants absorb and use crop nutrients more efficiently. DO can be measured and controlled although the equipment is typically reserved for larger scale growers.

Drain-Out Kit: A specialized kit or assembly supplied with piping and Drop-Tee's that enables individual Under Current Growth Modules and Epicenters to empty completely during or between cropping from a single or multiple drain port(s) with or without the use a Drain-Out Pump.

Drain-Out Pump: A centrifugal style water pump or pumps plumbed to a Drain-Out Kit. With a drain-out pump, Under Current systems can be emptied to levels above grade, whether for drain to waste or reclamation purposes.

Drip irrigation, drip system: An irrigation or fertigation method using a series of tubing to deliver controlled amounts of moisture directly to planting sites. Drip irrigation systems can range from very simple to very complex, both from a design and operation perspective.

Drop-Tee: A specialty plumbing fitting that allows water to drop below the level of the connecting pipes by gravity or pump action. Ideal for Drain-Out systems, ensuring that no water pools may remain inside grow modules between nutrient change outs or crop turns.

EC (Electrical Conductivity): A measurement of the relative concentration of fertilizer dissolved into a crop nutrient solution. EC meters, monitors and testers discharge a mild electrical current into the nutrient solution, where the resistance encountered is proportionate to the level of nutrient ions dissolved into the solution being tested or monitored. EC is the most universal reading for determining fertilizer levels in a nutrient solution and is the base value where TDS and PPM measurements are derived from following a conversion, for example TDS 400 and TDS 700 scales.

Epicenter: The "heart" of a recirculating deep water culture system (RDWC). Typically this is a UC module without a planting site where recirculating nutrient solution from the patented under current technology is continuously pumped back to before travelling through the system again. A float valve, monitors, dosers and other sensors may be installed at the EpicCenter.

Feeding Schedule: A system for supplying crop nutrition at varying strengths and ratios in order to best meet the specific demands for each phase in a crop life cycle. Often scheduled as a weekly regimen for propagation, vegetative growth, transitional development, early bloom, peak budding, ripening and flush. Professional level feeding schedules may also make distinctions for different types of growing methods or growth media types and environmental factors.

Fertigation, Fertigation System: The application of plant nutrients, fertilizers, additives or supplements to crops through an irrigation system. A fertigation system is similar in construction and operation to a variety of irrigation systems, i.e. pressure compensated drip systems, but is also designed to deliver applications of crop nutrients or nutrient solutions when watering crops.

Float Valve: A simple plumbing device typically installed in an EpiCenter or Reservoir that adds fresh water or nutrient solution from a supply as the nutrient solution becomes depleted from the system or reservoir. TIP: A float valve helps maintain more stable conditions in the root zone, for example pH or EC drift.

Flush: An application of fresh water or a mild nutrient solution in a quantity and/or frequency that is intended to lower the concentration of nutrients or fertilizers in the rhizospehere, growing media or internally with crops.

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Growth Module: A single or group of planting sites acting as a chamber for hydroponic roots in RDWC, DWC and aeroponics systems. Also referred to as a "mod". For example, a particular Under Current system may have eighteen Pro Mods running off of two Remote Epicenters.

HPAC (High Pressure Aeroponics Cloning System): A high density aeroponics system used to stimulate explosive root growth in propagating plant cuttings. High pressure misters in the rooting chamber intermittently deliver an oxygen and nutrient rich mist to cut stems supported by cloning collars. HPAC systems are highly modular and are popular due to their accelerated rooting times and ability to reduce veg time by propagating larger and fuller cuttings. When used in conjunction with UnderCurrent RDWC systems, the use of growing media is greatly reduced or may be eliminated entirely.

Hydroponics: Growing plants without soil or simply "water culture".

Joint: Interconnecting pipe between two growth modules.

Linear Air Pump: Air pumps that don't use traditional diaphragm technology. Linear air pump designs are based on a piston like in a car engine. They are much quieter and more reliable than diaphragm pumps or blowers meant to put out the same amount of air. They can be installed in a series to increase or decrease air output requirements as needed, i.e. scalable.

Liquid fertilizer: A complete or partial spectrum of elements necessary for crop development supplied in a liquid formulation. Liquid formulations are preferred for ease of application and measurement. Additionally, the elements are often solubilized versus dry fertilizers making them easier to dissolve into water for use as hydroponic nutrient solutions. Dry fertilizers may introduce contaminants into the growing area during mixing and handling, providing further benefit in use of liquid fertilizers.

Media Water Filtration: Typically one of the preliminary steps in RO (reverse osmosis) purification or may be used as a treatment for marginal water supplies where product water quality may not be as sensitive, i.e. dechlorination and sediment removal. The media in particulate filter(s) can be a blend or a combination of materials including zeolite.. NOTE: Commercial RO Membranes, Carbon Filters and Sediment Filters can be back washed for cleaning as part of regular maintenance to keep your RO system running at optimal for a longer filter working life.

Mother Plant (Donor Plant): The parent plant kept or maintained for the purposes of supplying vegetative shoots for use as rooting cuttings, i.e. cloning or asexual plant propagation. Crops propagated from a mother plant will share all the same genetic traits as the original donor plant.

Multi-Mod Chamber: The base growth chamber module for either HPAC or Commercial UC system. Using interchangeable lids, the module can fit hundreds of clones, several larger plants or one singular extra large sized plant. The multi-mod chamber may be used for DWC, RDWC and aeroponics. The multi-mod chamber represents the highest level of flexibility in a robust hydroponic system design.

Net Pot: A rigid mesh plastic pot designed to support a plant, for example in a CCH2O lid. The "open" design allows roots to grow into a depth of nutrient solution while maintaining adequate plant support and preventing light from entering the system.

Net Pot Insert: A purpose made or "tailored" disc fitting on top of a net pot to block out light and help reduce or negate the use of a growing medium.

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Net Pot Insert Collar: A composite foam disc, smaller than the Net Pot Insert (above) that supports a plant stem while allowing for growth when used in conjunction with a Net Pot Insert. The foam collars may also be used to support plants in HPAC (high pressure aeroponic cloning) systems.

Nutrient: An element(s) required for plant growth which may be supplied to the roots or through the leaves of crops. Nitrogen is an example of an element that is typically supplied through the roots while Carbon Dioxide is most commonly supplied through the leaves (as a gas).

Nutrient Change-Out: Emptying a hydroponic system, reservoir or stock tank during cropping to replenish with a fresh supply of nutrient solution. Nutrient change outs are typically performed weekly when following a crop Feeding Schedule.

ORP (Oxidation Reduction Potential): The potential of a disinfectant to inactivate microorganisms in bodies of water. It is a direct measure of disinfection power.

Oxidizer: A substance that has the ability to oxidize other substances, for example in the purpose of neutralizing unwanted substances.

pH (potential hydrogen): In scientific terms this is the negative logarithm of hydrogen ions in solution, i.e. the more H+ ions in the solution, the lower the pH value. In practical terms this is the measure of acidity to alkalinity of a solution or substance from 0 to 14, with 0 being most acidic and 14 being most alkaline. Most hydroponic systems and growing medium types will operate best in a pH range of 5.5 to 6.5. Optimal pH values help maximize nutrient absorption potential and healthy conditions in the root zone (rhizosphere).

PPM (Parts Per Million): A measure of the total concentration or specific elemental concentration of nutrient or fertilizer that is dissolved into a nutrient solution or as a measure of water quality.

Recirculating Deep Water Culture (RDWC): The patented Under Current® recirculating deep water culture (RDWC) system features a proprietary method to circulate oxygenated nutrient solution throughout the root zone. This approach ensures pH and EC levels are uniform during the growing cycle, resulting in unmatched productivity, efficiency, and ease of use. Ideal for integration with automation and fertigation systems for commercial standardization.

Regenerative Blower: Used for regenerating oxygen levels in nutrient solutions via aeration (pressurized air delivery pipe with air stones in nutrient solutions), similar in work duty to a linear air pump. Regenerative blowers are designed for higher aeration delivery and efficiency levels. Ideal for larger scale applications. Regenerative blowers have a very long service life versus other types of air pumps.

Remote Epicenter: As Above, with "Epicenter". The point of difference being that the Remote Epicenter may be installed at some distance from the UC RDWC system plant modules, for example outside the grow room or green house. This allows for convenient or centralized access while not interrupting photoperiods to perform manual checks or to service the system.

Reservoir: A tank or barrel used to store and/or recirculate water or nutrient solutions. Note, cisterns may be another term used although more often for fresh water storage rather than nutrient solutions. Reservoirs and other materials coming into contact with hydroponic nutrient solutions should be chemically inert, i.e. they do not react with the slightly acidic and saline nature of nutrient solutions or pure water (RO filtered water) supplies.

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Return Manifold: A pipe or tubing assembly designed to draw aerated nutrient solution through all of the growth modules in an UnderCurrent System back to the EPIcenter via a Return Pump.

Return Pump: A continuously recirculating pump that keeps the flow of water, nutrients and oxygen circulating from the Epicentre through each of the growth modules in the UnderCurrent System.

Reverse Osmosis: A water purification method that removes virtually all impurities from water sources, yielding product water that contains "0" parts per million (PPM) or dissolved solids (TDS/EC).

TDS (Total Dissolved Solids): Total dissolved solids (TDS) is the term used to describe the inorganic salts and small amounts of organic matter present in solution in water.

UC Comm Mod: An Under Current growth module used in Commercial UC Systems of larger capacity (30 gallon) and footprint versus UC 8 gallon and UC XXL 13 gallon growth modules.

UC Module Cage: A heavy gauge galvanized wire support system for crops that is easily collapsible and stackable when not in use. A UC Module Cage helps maximize canopy management potential for healthier plants and bigger yield potential.

UC Parka: An insulative and reflective protective jacket that fits various Under Current System Growth Modules. UC Parkas can help reduce heating and cooling requirements while helping to buffer the root zone from external environmental changes.

UC Solo System: A DWC (deep water culture) system offered by CurrentCultureH2O using a multi mod. These systems are highly expandable and adaptable. While ideal for smaller scale growers, larger scale growers use UC Solo Systems to help establish transplants for larger RDWC set ups.

UC SpinTight Bulkhead: A heavy duty large diameter plumbing connector that allows larger diameter rigid piping to connect to growth modules, epicenters or reservoirs. These fittings are an integral part of professional RDWC system construction and are also widely adopted for a variety of growing system construction or application types.

Under Current System: The patented Under Current® recirculating deep water culture (RDWC) system features our proprietary method to circulate oxygenated nutrient solution throughout the root zone. This approach ensures pH and EC levels are uniform during the growing cycle, resulting in unmatched productivity, efficiency, and ease of use. Ideal for integration with automation and fertigation systems for commercial standardization.

VPD (Vapor Pressure Deficit): The amount of water vapor in the air surrounding the plant's leaves plays a strong role in regulating the plant's potential rate of photosynthetic activity–this is what VPD (vapor pressure deficit) is all about. When out of the sweet spot, crops suffer, and can easily be overworked to the point of stress or damage if humidity levels fall too low. Conversely, an overabundance of humidity will stifle growth rates, causing stretchy and weak growth that is prone to problems.

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This FAQ covers the integration of UC Systems with other supporting equipment, as well as final system set up and calibration.

- In-line Chiller vs Centralized Chiller Loop for Solution Cooling

Q: Is a chiller required to chill water in my UC System?

A: Generally yes. Considering the room ambient temperature influences water temperature, and grow environments are typically 78-84F, water temps can reach the high 70's. Target water temperature is 65-68F, making a water chiller a necessity to maintain a healthy water chemistry.

Utilizing stand alone water chillers or centralized heat exchanging chiller loops enables the cooling of the nutrient solution in the system, enhancing plant performance and reducing the likelihood of pest and disease.

Q: Why is the nutrient solution temperature so important in the UC System?

A: Maintaining cooler water temperatures inhibits pathogens from colonizing as well as enables the body of water to reach high dissolved O2 levels.

Q: What type of chiller approach is best for my UC System?

Depending on the scale of the application, there is a cooling approach that is easily adapted to integrate with the UC System.

- In-line Chiller (Residential)

With this application, the UC System recirculating pump is plumbed directly to the chiller, with the solution circulating through the chiller and back into the system. This application is simple to install and well suited for applications with a limited number of systems.

1. Locate the chiller in proximity to the return pump and Epicenter. If possible, have the chiller placed outside of the growing environment to reduce the heat load emitted by the chiller.
2. Plumb the 1" line from the outlet of the re-circulatory pump directly to the inlet of the chiller.
3. Plumb the 1" line from the outlet of the chiller to the inlet of the Epicenter.
4. The chiller will run as regulated by the internal thermostat as needed based on the desired setting.

- Centralized Chiller with Heat Exchangers (Professional/ Commercial)

With this application, one or numerous commercial chillers are centrally located in a facility for solution cooling. This chiller, or bank of chillers is plumbed throughout the facility to deliver a cool water loop to various heat exchangers throughout the location.

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This cool water loop (generally a combination of water and glycol), is circulated out, with a return circuit delivering the warmer (heat exchanged) water back to the chiller location. In this application, the chiller/s cool this body of glycolized H2O which is then pumped back out into the heat exchanging loop.

Heat exchanging devices, such as coils or shell and tube exchangers, interface with the UC Systems to facilitate the solution cooling. In this application, the nutrient solution in the systems does not pass through the chiller, but rather comes in contact with the heat exchanger where it "exchanges" its warmer temp to the HE (heat exchanger) in turn for the cooling effect on the nutrient solution.

This application is better suited for commercial applications, as it generally utilizes professional equipment and necessitates installation expertise in the HVAC and plumbing fields. Below is a summarized run down of the install process.

Contact tech@cch2o.com for details.

- Connecting the Top-Off Tank (Residential)

Q: What is the function of a Top-Off Tank?

A: As the plants grow, solution will be up taken and transpired into the environment. This will lead to the UC System volume reducing and requiring replenishing.

Q: How will this improve the operation of the UC System?

A: With a Top-Off tank connected to the float valve in the Epicenter, allows a make up solution to refill the system automatically, maintaining a more consistent water volume and chemistry.

Q: How is a Top Off Tank sized for a specific UC System application?

A: A proper tank should be the equivalent to the total system volume of the system the tank will be servicing. This allows for the tank to be used to mix full batches of nutrient solution for the UC. If the Tank is servicing several systems, the volume should be the equivalent of the total number of gallons of the collective systems.

Q: Does the Top Off Tank need to be aerated?

A: Assuming the solution is exchanging through the top off tank within a couple days, it's unnecessary. If longer periods exist, consider dropping in an air stone to homogenize and aerate.

Q: Does the Top Off Tank need to be chilled?

A: If chilling the UC System, it's generally unnecessary to chill the Top Off Tank. Chilling will be handled in the UC.

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Q: What is the basic process for connecting a Top Off Tank to one UC System?

A:

1. Position tank adjacent to the Epicenter. The tank should be positioned outside the grow room for efficiency.

If using gravity to feed from Top-Off to the float valve, the TO (Top-Off) tank should be elevated above the float valve, and located no more than 4 feet from Epicenter.

If using a booster pump to deliver from TO to float, a great distance is acceptable, generally up to 30 feet.

2. Connect any necessary plumbing adapters to allow for an interface with the provided RAK (reservoir adapter kit).

3. Connect the plumbing fitting at base of TO tank to the float valve in the Epicenter of the UC System.

4. Make sure the float is oriented (upright) correctly, with the nut tightened securely to the wall of the Epicenter Module. The Top-Off tank and float valve are connected and ready for operation.

- Auto Top Off or Batch Tank (Professional/ Commercial)

Q: How would this differ from a manual Top Off Tank?

A: With a Top-Off tank connected to the float valve in the Epicenter, the makeup solution refills the system automatically via gravity or pump trigger, maintaining a more consistent water volume and chemistry.

Q: Is there a benefit to taking this automated approach?

A: Generally yes, assuming it suits the application budget and personnel. With an Auto Top Off approach, the solution refills the system automatically directly from a fertigation system or via batch tanks. This application requires automation and is better suited for facilities vs residential.

Q: What are some examples of automated approaches for managing nutrient solutions in the UC System?

A: There are a variety of additional approaches that suit various applications. Depending on scale and budget, managing nutrients can be a fully automated process with data tracking, analytics and prediction capabilities.

Generally speaking, the sophistication of the equipment should be consistent with the level of expertise of the operator so the fertigation component is contributing to ease of use, rather than causing potential issues. Below are a few applications.

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- Central Fertigation Batch Tank Method.

This automated approach is well suited for large-scale applications, this approach utilizes a functional fertigation system (metering pumps with a primary control panel) to proportion base nutrients, acids and oxidizers as preprogrammed per specific needs.

This central fertigation system produces specific recipes which are sent to batch tanks to await delivery out to systems in the facility as needed.

The fertigation controller coordinates pump and solenoid sequencing to drain systems and deliver the nutrient solution directly to systems as needed.

This method affords for several batches to be produced and delivered within a shorter period of time than the CFDS (Central Fertigation Delivery System) method.

Sufficient production and storage of RO water to supply the daily batching is required.

Systems in the field will have water chemistry monitored via remote sensing platform and/or field techs making readings and logging data.

Each day, systems lose solution volume via evapotranspiration and need replenishing. The solution remaining in the system is predictably lower in EC, with a rising pH (0.1 increase per day is typical) when systems are properly operated.

To facilitate refill, nutrient solution is automatically delivered to each system through a float or sensor triggered supply. This solution make up is generally slightly acidic (to offset the rise in pH) with a dilute solution of the nutrient recipe for a given phase.

This approach results in EC and pH adjustments that are performed gradually, minimizing the micromanagement and the need for frequent adjustments. This provides superior nutrient solution stability and positive results.

Accompanied by field techs making remote readings and logging data, this approach provides the most efficient and productive way to manage CCH2O systems.

Required Equipment includes - Central Fertigation System, Hand Held Meters, Delivery Pumps/Solenoids, Supply Plumbing Infrastructure, Tanks, Nutrient Solution Storage, Tanks, RO Water Storage

Pros - Efficient, Repeatable Results, Data Trackable, Automated, Reduced Labor, Centralized

Cons - Cost, Requires More Space for Tanks

- Automated Top Off Tank Method.

Suited for small-scale facility applications, this approach utilizes a small spot doser to proportion base nutrients, acids and oxidizers in a batch tank. This pH balanced blend is then delivered directly to systems, generally via pump and supply plumbing as needed.

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With this approach, one tank and doser pairing generally blends and pH adjusts a singular recipe vs a fertigation approach which blends numerous batching recipes.

Systems in the field have water chemistry monitored via remote sensing platform and/or field techs making readings and logging data.

Each day, systems lose solution volume via evapotranspiration and need replenishing. The solution remaining in the system is predictably lower in EC, with a rising pH (0.1 increase per day is typical) when systems are properly operated.

To facilitate refill, nutrient solution is often manually delivered via pump to each system through a float. This solution make up is generally slightly acidic (to offset the rise in pH) with a dilute solution of the nutrient recipe for a given phase.

This approach results in EC and pH adjustments that are performed gradually, minimizing the micromanagement and the need for frequent adjustments. This provides superior nutrient solution stability and positive results.

Required Equipment includes - Spot Doser, Hand Held Meters, Delivery Pumps, Supply Plumbing Infrastructure, Tanks, Nutrient Blending, Tanks, RO Water Storage (optional)

Pros - Efficient, Automated, Reduced Labor

Cons - Cost, Limited

- Automated Spot Doser Method.

Suited for small-scale facility applications, this approach utilizes a small spot doser to proportion base nutrients, acids and oxidizers directly on the UC System.

This approach requires the production and storage of RO, sufficient to supply the daily requirements for production. Systems water chemistry monitored and adjusted directly by this integrated spot doser.

Each day, systems lose solution volume via evapotranspiration and need replenishing. The solution remaining in the system is predictably lower in EC, with a rising pH (0.1 increase per day is typical) when systems are properly operated.

To facilitate refill, pure RO water is delivered via pump or gravity to each system through a float. The doser then makes adjustments based on readings being taken directly in the system.

This approach results in EC and pH adjustments that are performed daily, erroring towards micromanagement, providing less nutrient solution stability.

Required equipment includes - Spot Doser, Hand Held Meters, Tanks, RO Water Storage.

Pros - Efficient, Automated, Reduced Labor

Cons - Cost, Limited

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- Filling the System with Nutrient Solution

Q: Should nutrient solution be mixed directly in the UC System?

A: No. UC Systems are designed to circulate nutrient solution, not for mixing nutrient solution. Always premix, pH balance and stabilize the nutrient solution in a batch tank before pumping into the UC System.

Q: How is system volume calculated?

A: Considering the slight variance that occurs relative to specific float valve calibration, system volume calculations are approximate.

To calculate, simply multiply the total number of modules (including the Epicenter) by the target module volume.

Take this number and multiply this number by 105% for (UC/UCXL) or 110% for (UCXL13/ UCXXL13).
This % multiplier is to account for manifold volume..

- UC/ UCXL - 6.5 Gallon
- UCXL13/ UCXXL13 - 11.5 Gallons

The following example is for a UC16XL13:

(17) modules x (11.5) gallons = 195.5 Gallons

(195.5) gallons x (110%) = 215 Gallons Total system Volume

Q: What is the blending sequence when mixing nutrient solution?

A: Hand Mixing Process for Top Off Tank (Residential)

1. Fill tank with pure water.
2. Begin recirculation mode of the tank. (see sequencing chart for details)
3. Add recommended dose of UC Roots
4. Add recommended dose of Cococal
5. Add recommended dose of A Formula
6. Add recommended dose of B Formula
7. Add recommended dose of Bud Booster
8. Add recommended dose of Mycostop (dilution) as needed.
9. Follow specific Mycostop recommendation to create pre-dilution.
10. Allow to recirculate for 15 minutes.
11. Check pH and EC to ensure the target is achieved.
12. Adjust pH as needed.
13. Allow to recirculate for 1 HR and retest pH.
14. Once confirmed, the nutrient solution is ready for transfer into the UC System.

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Q: What if utilizing an automated fertigation approach?

A: Considering this will be a programmed event, refer to the operational details of your specific fertigation and batching process.

Q: How is it determined the nutrient solution is acceptable for introduction into the system?

A: Once balanced and stable, the nutrient solution should be pumped directly into the system until desired water level is reached. This can be done via the main Utility Pump.

- Leak Testing the UC System

Q: What if my UC System leaks?

A: Under Current systems are built with professional plumbing components, proven to operate leak free for years. In the event any potential initial leaks occur, these leaks can be eliminated by simply tightening the associated fittings.

Follow the steps below to leak test your system.

1. Fill the system with water to just above bulkheads.
2. Check for any obvious leaks and address by tightening associated fittings.
3. Initiate water pump.
4. Check again for any leaks and address by tightening associated fittings.

Additional tightening of bulkheads may be needed once the system is completely full of water. Address this by tightening associated bulkhead fittings as needed..

If a leak is discovered that you're unable to fix, email tech@cch2o.com for support.

- Setting Float Valve

Q: Should water level in the system be changed throughout the cycle?

A: No. The system volume should remain consistent throughout the cultivation process. Maintaining a consistent volume creates stability and reduces the likelihood of error in the event adjustments are made.

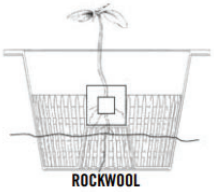
Q: Where should the water level be set?

A: If operating the system with bare root propagated plant stock, the water level should be maintained at 0.5-1" above the planting deck. Solution should be in contact with the roots but not above the root crown (upper most portion of root mass).

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If operating the system with rockwool propagated plant stock, the water level should be maintained 0.5-1" below the planting deck. Be sure the solution is not in constant contact with the rockwool or over saturation and plant health issues will occur.



- Initiate Aeration and Calibrate IWC

Q: Water is IWC?

A: IWC (inches of water column) is a measure of flow into a column of water. This metric will aid in standardizing the aeration in the UC System. Useful when running multiple systems to assure all systems uniform aeration.

Q: Is it possible to over aerate the UC System?

A: Yes. Operating air pumps in excess of recommended IWC targets can lead to excessive root disturbance and destabilization of the nutrients in solution. Proper aeration is sufficient to increase DO levels and agitate solution, but should not be so disruptive as to negatively affect sensitive plant roots.

Q: What is the target IWC for the UC System?

A: Recommended targets :

8 Gallon @ 25-30 IWC

13 Gallon @ 30-35 IWC

Q: How is the AFR calibrated with the correct target IWC?

A: Once the UC System is full of solution and all prior steps accomplished carry out the following steps to calibrate your aeration system.

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1. Plug in pump or pump bank.
2. Use the valve on the AFR to set a target IWC reading.

    To decrease the IWC, open the bleed valve on AFR.

    To increase the IWC, close the bleed valve on AFR.

3. Once set, the valve will not require further adjustment.

Q: How often should the air pump be operating?

A: The air pump should be running 24/7, anytime water is in the system. Always remove air stones from the nutrient solution before disengaging the pump.

Q: Should the air pump be unplugged while nutrient solution is in the system?

A: No. Doing so can result in a siphon action that will pull nutrient solution and debris into air stones rendering them less effective.

Q: Aside from calibrating the IWC, is there anything that should be checked to assure aeration is functioning properly and ready for operation?

A: Yes, check each module to verify the air stones are all operating properly. Note, in some instances there may be small differences in output due to inconsistencies in the stones, but this will equalize after a day or so of operation.

Q: Is it possible to operate multiple UC Systems with (1) larger pump or regenerative blower?

A: Yes this is referred to as Centralized Aeration. It involves the routing of primary trunk lines from a centrally located pump source. The trunk line networked to the various UC Systems being serviced via branch lines. The aeration is delivered in a uniform fashion with the implementation of valves and Air Flow Regulators (AFR).

Contact tech@cch2o.com for details.

- Initiating Primary Recirculation Water Pump

Q: Does the recirculation pump run 24/7?

A: Yes, the recirculatory pump should be plugged in and operating throughout the planting cycle.

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Q: Does increasing my pump size (GPH), improve the function of the UC System?

A: Not necessarily. The function of the pump is to homogenize the solution, keeping it properly mixed providing for uniformity throughout the system.

Q: Is there a situation that would benefit by upsizing the recirculatory pump?

A: Pumps are sized appropriately for systems, with the only need for pump upgrade taking place in the event head pressure (friction resistance on output) is increased.

This can be the case when running solution through a chiller and back to the Epicenter takes place. In this instance, it is necessary to calculate the run distance and compensate by increasing pump output.

Generally if distance from pump to chiller and back to Epicenter is less than 6 ft, no increase in output is required.

Q: Once filled with solution, IWC and float valve are set, is the UC System ready for planting?

A: Before transplanting into the UC System, allow the solution to circulate and stabilize. This should be no less than (1) hour and no more than (4) is necessary.

- Install Lids and Prep for Planting

Q: What is the final step to physically assembling the system before it's prepped for accepting transplants?

A: Once all basic previous steps have been carried out, lids can be installed in preparation for planting.

1. Position lids with port hole oriented towards the rear (opposite of Epicenter) of the system.
2. Make sure they are securely resting on the growth module.

System is ready for planting.

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This FAQ covers topics related to managing plants and water chemistry in the UC System.

- Transplanting into CCH2O Net Pots

Q: Should this transplant happen in the grow room? Will the plants go directly into the system?

A: Transplanting should not be performed in the grow room, but instead a clean, purposed area for transplantation. Once transplanted, planted cuttings should be placed immediately into awaiting UC System to ensure hydration and reduce transplant shock.

Q: What source of cuttings is best for transplant into the UC System?

A: Utilize bare root or rockwool propagated cuttings for best results. Be sure cuttings are properly rooted and robust before considering transplantation.
**Do not transplant cuttings or juvenile plants from soil into the UC System as this may lead to CROP FAILURE.

Q: Can seedlings be transplanted into the UC System?

A: Yes. As with cuttings, assure the seedlings are properly rooted and robust before planting and either sown in rockwool or bare root to avoid potential issues.

Q: Should the transplants be treated with any specific product during the planting process?

A: Consider immersing plant roots in Mycostop dilution during transplantation into net pots. This inoculation will aid in reducing opportunistic disease pressures if encountered or present during transplantation.

Contact tech@cch2o.com for usage details.

Q: What are potential concerns when transplanting into a new environment?

A: When dialing in the cultivation room be sure to match as many of the environmental and water chemistry conditions with those of the previous environment to minimize shock. Before transferring the transplants into the UC System, check all room equipment and parameters to assure the environment and water chemistry is suitable for plant growth.

Q: Is it possible to transplant rockwool cuttings into the UC System?

A: Yes, there is a specific recommendation for planting and setting water level in the system to accommodate rockwool propagated cuttings.

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Q: Can rockwool propagated cuttings be transplanted into the new CCH2O Net Pot Inserts?

A: Yes.

Q: What are the steps for transplanting into the Net Pot and Net Pot Insert?

A:
-Transplanting bare root cutting into a porous stone media

1. Rinse grow rocks/stones thoroughly, if possible, soak 24 hours pH 5.5 solution.
2. Fill in porous stone media to be level with the planting deck.
3. Place bare root cutting gently above the planting deck and carefully back fill the media until filled just above the root crown (most upper roots on stalk of cutting).
4. Place the planted Net Pot immediately into the UC System Lid to ensure proper hydration.

-Transplanting rockwool cutting into a porous stone media

1. Rinse grow rocks/stones thoroughly, if possible, soak 24 hours pH 5.5 solution.
2. Fill in porous stone media to be level with the planting deck.
3. Place rockwool cutting gently above the planting deck and carefully back fill the media until filled just above the root crown (most upper roots on stalk of cutting)
4. Place the planted Net Pot immediately into the UC System Lid to ensure proper hydration.

-Transplanting bare root cutting into CCH2O Net Pot Insert

1. Locate CCH2O Net Pot Insert Collar.
2. Gently place the stalk of cutting, just above the root crown (most upper roots on stalk of cutting) into the NPI Collar.
3. Place NPI Collar into the recessed portion of the NPI, seated atop the Net Pot.
4. Place the planted Net Pot immediately into the UC System Lid to ensure proper hydration.

-Transplanting rockwool cutting into CCH2O Net Pot Insert

1. Locate CCH2O Net Pot Insert Collar.
2. With NPI nested atop the Net Pot, rest rockwool cutting gently above the planting deck. Once stabilized, gently place the stalk of cutting, just above the root crown (most upper roots on stalk of cutting) into the NPI Collar.
3. Place the planted Net Pot immediately into the UC System Lid to ensure proper hydration.

- Transferring Transplants into the UC System

Q: How should plants be moved into the primary UC System from the transplanting area.

A: To streamline processes and increase efficiency, consider utilizing a rolling cart to transfer numerous transplants at once. Aside from improved workflow, this approach minimizes transplant exposure during travel.

Q: During travel to primary UC Systems, do the transplants need to be hydrated?

A: To decrease stress and improve hydration, consider foliar spraying with a mild nutrient solution every few minutes. This will help plants retain turgidity and remain vigorous during the transition.

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Transplants should be transitioned into the system and immersed in solution as soon after transplantation into Net Pots as possible to reduce stress.

Q: Do the plants require additional top feed irrigation (hand watering) once they've been transplanted?

A: Always assure transplants roots are fully immersed in the solution and there is no need for additional watering. Plant roots in solution enable plants to hydrate and maintain health during transition.



Q: Will plants begin to grow immediately, once moved into the system?

A: Generally it takes the transplants a few days to adapt into the UC System and new environment. The more care and detail put into a smooth transplant and transfer, the faster the plants will adapt into the UC System and begin to flourish.

- General Observations and Considerations

Q: Once the plants are in the system is there need for daily observation?

A: Yes. Though the system is a fully automated irrigation system, its operation alone does not ensure plants grow properly. As well, it's important to check the function of the system and elements within the environment to assure all are in working order

Q: What are some considerations and routines that should be carried out to assure a functional grow space?

A: Check general plant health on a daily basis to stay ahead of any possible issues that may develop. Keep an eye on leaf tropism, turgidity, morphology and luster for reference.

Avoid disrupting plants to encourage full and productive flower development. Maintaining stable water chemistry and adequate humidity will aid the plants during this transition period. Check regularly for pests and disease.

pH, EC/PPM, ORP and water temp should be monitored on a daily basis. Generally EC/PPM should drop gradually while pH rises slightly. If this isn't the case, there may be need to adjust water chemistry. Record the observed conditions in a cultivation log.

Adjustments should be made seldomly and in a gradual fashion as outlined in "Managing Hydroponic Water Chemistry During Cultivation" section.

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Root Pruning, Training and Trellising

Q: Is there concern with roots growing into the plumbing of the UC System?

A: Yes. As the plants develop, root masses will begin to fill the growth modules and may grow into the plumbing. To reduce the likelihood of issue from this process, it is recommended to periodically prune the plant roots.

Q: Are there any particular area of the system that should be monitored for root growth more than others?

A: Yes. Monitoring and maintenance is particularly important in the growth modules connected to the Return Manifold as this is the point where root incursion is most likely. Follow the steps outlined below.

1. Root pruning should only be done as needed with no more than 10-15% of the root mass pruned at any one time.
2. Examine the root structure and look for uneven growth. Using a sterilized pair of scissors, prune the most peripheral roots to maintain a compact and uniform root mass.
3. Generally, begin root pruning when plants are just beginning to develop roots. Identify roots that are growing disproportionately and trim them to stay even with the adjacent root mass.
4. It is important to only prune the outermost root mass to ensure optimum root health. Root pruning should cease once in the flowering cycle. See examples of properly pruned roots below.

Q: Is it necessary to support crops growing in the UC System?

A: Yes. The utilization of UC Module Cages or basic trellising practices is useful in providing support for the branches and stabilizing the plant. See images below for examples of utilizing trellis for plant support. Continue supporting flowers by stabilizing within trellis netting or cage.

- Establish and Maintain Suitable Conditions For Growth

Q: Will operating the UC System as recommended compensate for a poor growing environment?

A: No. In order for plants to grow properly with any irrigation method, environmental conditions need to be dialed in and maintained throughout the growing cycle. Physiological functions such as solution uptake, photosynthesis and evapotranspiration are limited based on factors such as temperature and VPD.

Researching the necessary parameters for your given crop and establishing these conditions before planting your UC System is paramount to success. Failure to create a suitable environment will result in poor results and/or crop failure.

Below are some basic conditions and recommended targets to be considered for an average cropping cycle.

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Weeks →Cycle	Veg Week 1	Veg Week 2	Veg Week 3	Veg Week 4	Bloom Week 1	Bloom Week 2	Bloom Week 3	Bloom Week 4	Bloom Week 5	Bloom Week 6	Bloom Week 7	Bloom Week 8	3 to 7-Day Flush
Temp - Day (F°)	86°	84°	82°	80°	79°	79°	78	77	76	76°	75	75	70°
Temp - Night (F°)	70°	70	70°	69°	69°	69°	68°	68°	68°	67°	66	65	63
Relative Humidity - Day	75%	75%	70%	70%	65%	65%	65%	63%	61%	60%	60%	50%	40%
Relative Humidity - Night	60%	60%	60%	60%	60%	60%	58%	58%	58%	56%	56%	54%	50%
VPD - Day (kPa)	1/1.1	1/1.1	1/1.1	1.1/1.2	1.2	1.2	1.15/1.2	1.2	1.2	1.2/1.3	1.2/1.3	1.4/1.5	1.5
VPD - Night (kPa)	1	1	1	1	1	1	1	1	1	1	1	1	1
CO2 (ppm)	1500	1500	1500	1400	1350	1350	1250	1200	1100	1000	900	800	500
PPFD µmol/m²/s	300-600	300-600	300-600	300-600	600-900	600-900	600-900	600-900	600-900	600-900	600-900	600-900	600-900

Managing Hydroponic Water Chemistry During Cultivation

Q: What is the single most important aspect when operating a UC System?

A: The management of water chemistry is the most challenging aspect of operating a hydroponic cultivation system at any scale.

Monitoring and managing pH and EC during the planting cycle is the single most important process to ensure crop health. When done properly, plant growth is vigorous with little need for daily adjustment or micro management.

Q: What is the likely outcome for a hydroponic crop when water chemistry is not properly maintained?

A: When mismanaged, crop health suffers, leading to diminished yields and much less efficient use of time.

In its most effective and productive form, RDWC system operation should be simple and predictable. Below are some thought guidelines for approaching water management that will improve results and streamline maintenance processes.

Below is a general water chemistry parameter chart for reference.

PPM 500	100	175	300	325	425	500	600	650	700	650	450	400	0-100
PPM 700	140	245	420	455	595	700	840	910	980	910	630	560	0-100
EC	0.2	0.3	0.6	0.6	0.8	0.8	1.2	1.3	1.4	1.2	0.9	0.8	0.1
pH	6	6	5.9	5.9	5.9	5.9	5.9	5.8	5.8	5.8	5.8	5.8	5.7
TEMP	68°	68°	68°	68°	68°	68°	68°	68°	68°	68°	68°	65°	62°
ORP	350-400	350-400	350-400	350-400	350-400	350-400	350-400	350-400	350-400	350-400	350-400	350-400	350-400
DO MINIMUM	8 mg/L	8 mg/L	8 mg/L	8 mg/L	8 mg/L	8 mg/L	8 mg/L	8 mg/L	8 mg/L	8 mg/L	8 mg/L	8 mg/L	8 mg/L

- Selective Ion Mineral Uptake in RDWC?

Q: Should a grower be concerned that the minerals in the hydroponic solution are becoming imbalanced due to uptake variances during cultivation?

A: Generally no. There's a misconception that when growing in RDWC the plants uptake ionic minerals disproportionately, absorbing some but leaving others. This in turn leads to mineral imbalances, leading to deficiencies or toxicities.

Though it turns out, this isn't the case. Normal solution uptake results in very little change to mineral ratios, pH and EC. When RDWC is operating properly, the solution left behind is slightly more alkaline with a reduced EC. Combined with the hydroxyl ions and root exudates produced by the plant roots, this solution requires minimal periodic adjustments, while remaining vital and available for further uptake.

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Q: How do plants uptake minerals in solution?

A: During the cultivation cycle, mineral ions in solution are uptaken proportionally as they occur in solution. RDWC plants metabolize these minerals, governed by factors such as pH, mineral ratio, solution temperature and relative humidity.

Because the dissolved mineral ions are completely absorbed by plant roots, the proportion of mineral ions in solution remains relatively constant. Though there can tend to be variations in general EC and pH, the actual mineral ratios tend to remain unchanged.

Q: What are some things that change in the water chemistry during the planting cycle?

A: As plants uptake the solution, they simultaneously exude sugars and hydroxyl ions. This exchange influences water chemistry and results in the need for adjustments.

Q: It seems the solution in the system will stagnate due to being in the system for several days at a time, is this a concern?

A: No. Because plants are uptaking the nutrient solution, the system volume will be depleted, which can ultimately empty the system. As a result, topping off the nutrient solution is a necessary and effective means for maintaining a balanced diet of minerals in solution for plants. This is most often accomplished through the use of a float valve plumbed to a Top Off Tank or fertigation system.

Q: Why is Topping Off the solution the most recommended method for maintaining proper water chemistry?

A: Aside from being the most input conservative way to operate an RDWC system, this Top Off approach provides a stable root zone environment, allowing plants to flourish in the nutrient solution.

- Water Source & Quality

Q: Is Reverse Osmosis water necessary to operate the UC System?

A: Depending on water quality it is not always necessary to operate an RO unit to purify source water. A general rule of thumb is if water is in excess of 150 TDS, than consider operating an RO. It is always possible to blend unfiltered water with RO (low TDS water) to achieve a better quality water.

Q: Is there a low cost method for determining if an RO is necessary other than a lab analysis?

A: For basic TDS readings, a low cost pen or monitor is suitable as well as useful during the cultivation cycle.

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Q: What is the recommended approach to establish actual water quality?

A: To gain a clearer understanding of what minerals and contaminants are contained within source water, consider running a basic mineral analysis. Check out the link below for affordable testing.

Well Water - Sources are typically more difficult to manage as they can change seasonally and require special monitoring depending on the region.

https://mytapscore.com/collections/well-water-tests/products/essential-well-water-test

Municipal - Generally you can contact a municipality to get a recent water report for reference.

Q: Does an RO treat water to eliminate pathogens?

A: No. If there is concern that water may contain pathogens, a more comprehensive microbiological analysis can be run to assess the hazards.

https://mytapscore.com/collections/microbiology-water-tests/products/total-microbiology-water-test

Q: What if my water contains pathogens? Is it still possible to grow in an RDWC system?

A: Generally yes, though the details involved to treat the problematic water may be prohibitive. If water quality proves to be an issue, contact tech@cch2o.com to be connected with professionals to treat your water's specific issues.

- pH Management

Q: Why is pH something that need be monitored so closely in the UC System?

A: Solution pH influences the availability of primary macro and micro nutrients to plant roots. If pH values are maintained within the proper range, plants are able to uptake nutrients in solution, ensuring hydration and nourishment throughout the cropping cycle.

Q: Is it necessary to maintain a specific pH set point in the hydroponic nutrient solution for plants to grow?

A: No. Making daily adjustments can destabilize the nutrient solution and interrupt plant growth. Allowing the pH to swing upward reduces the necessity for adding pH adjuster and helps maintain a more stable and available solution.

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Q: What can be done to minimize the need for pH adjustments and reduce the need for micro management?

A: To optimize mineral uptake, a target range of 5.7-6.3 should be maintained. This range allows for ample availability of minerals and micros throughout the planting cycle.

If a partial nutrient change out is performed weekly, the recommended range should allow for a 7 day period with no need for adjusting pH. This approach both improves plant health and reduces the associated labor necessary for micro-managed operation.

Q: Can adjusting pH too frequently be harmful to the health of my crop?

A: Yes. Though not often considered life threatening, improperly adjusting pH can lead to plant stress and ultimately crop failure in severe cases. The way pH management is approached can largely dictate success or failure. Below are considerations when developing your approach.

Frequent adjustments to a hydroponic system's water chemistry destabilizes the solution, interrupting solution uptake causing root damage and potential crop loss. Adjustments should be made seldomly and in a gradual fashion.

In a healthy hydroponic system, pH generally increases by +/- 0.1 per day as plants excrete hydroxyl ions and uptake minerals.

Q: How can this allowance of a broader target range be accomplished if using an auto doser to maintain pH and EC levels?

A: Though the implementation of a doser can lead to frequent adjustments, there are ways to reduce the potential negative impact of these changes.

1. Set broad differentials to afford more swing before the pH adjuster is auto dosed. This will reduce adjustment events.
2. Dilute pH adjuster from concentrate to reduce acute changes to water chemistry and encourage homogenization.
3. Use stable nutrients that require less frequent adjustment.
4. Communicate with your automation provider and convey your needs so they can assist in making any necessary operational adjustments.

Q: What if the pH needs to be adjusted during the 7 day cycle?

A: Generally, a hydroponic solution pH should rise slightly each day. A healthy solution pH ascension is +/- (0.1) per day, though the solution may rise faster in some conditions.

If pH is rising more than (0.2) per day, consider raising the EC back 10% to stabilize the solution. The presence of more acid minerals in solution will help offset the addition of hydroxyl ions by plant roots and work to stabilize the solution. Follow the steps below for active pH adjustment:

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1. **Remove 25% of your system volume into your Top Off/ batch tank.**
2. **Adjust this solution to 0.2 below (or above if target is UP) relative to your target pH.**
3. **Add this solution back into the system and allow it to homogenize.**
4. **Once the solution is blended, the should normalize at +/- target range.**

Q: Is it possible to execute "Add Backs" directly to the UC System? Meaning, can diluted nutrients or pH adjuster be added directly to the Epicenter?

A: Generally the nature of "Add Back" type adjustments make them prone to error and ultimately end up causing plant stress.

But, if necessary, this type of adjustment provides a reliable means for increasing EC. Take the following steps to minimize hazards during adjustment**.**

Q: What is the correct process for adding nutrients back "add back" directly into the system?

1. Determine the amount of concentrate you're looking to add back into the system to raise EC. Generally, (1 mL) of nutrient concentrate added to (1) gallon of solution raises the PPM by 30. CCH2O generally recommends adding back no greater than a 400% solution. Meaning it would be similar to a typical solution at (4X) the strength as an add back solution. If too highly concentrated, the Add back can result in poor homogenization and lead to crop stress.
2. Dilute this solution into no less than 5 gallons of water to make this add back solution. This larger volume will help in homogenizing the add back.
3. Introduce gradually back into the system via the Epicenter. Generally, adding in approx (1) gallon of this 400% solution every 5 minutes until add back is complete.
4. AVOID ABRUPT CHANGES TO WATER CHEMISTRY. If a larger change in parameters is necessary, follow the steps outlined in the previous instruction by removing a volume from the system, adjusting, then reintroducing back into the system to homogenize.

Q: Is there a simple process for assessing water chemistry?

pH Rise > EC Drops = Normal > Indication system is operating properly.

pH Drops > EC Rises = Abnormal > Indication EC is too high > Reduce EC by 10-15% and observe.

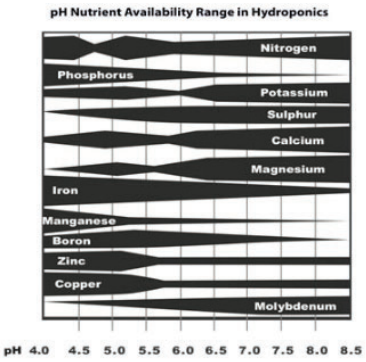
pH Rise > EC Rises = Abnormal > Indication there may be issue with meters > Calibrate and recheck.

pH Drops > EC Drops = Abnormal > Indication there may be microbial issue > Drain 50%, refill and observe > Rootzone treatment such as Mycostop generally recommended

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Q: Is there a chart that illustrates what ions are available in relation to pH ranges?

A:



EC Management

Q: What role does EC/ TDS play in the operation of the UC System?

A: Solution EC dictates the total available minerals in solution as well as the rate of uptake relative to the osmotic pressure in the rootzone. If the EC is too high, pH can drop and solution uptake can become impaired leading to issues with evapo-transpiration and hydration.

Q: How does crop health benefit from maintaining proper EC?

A: Maintaining target EC levels reduces the likelihood of uptake disruption and encourages consistent growth during cropping. There is generally a corresponding relationship between pH and EC that can be observed to help make management decisions during cropping. Learning how to read these signs is useful and necessary as management practices are developed and executed.

Q: Is there a predictable trend that can be observed when water chemistry is in the optimal range?

Generally throughout the week as plants uptake the nutrient solution, EC should drop and pH should rise. This trend calls for a Top Off solution that replenishes the solution while influencing the chemistry to within target ranges. Meaning when operated properly,

Q: How does the Top Off solution factor into this observation of EC and pH?

A: Top Off solutions will tend to be a higher EC and lower pH than the solution in the system.

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Q: Does EC and pH need to be monitored in the Top Off tank.

A: Yes, but generally it stays relatively stable due to the absence of influencing factors such as root exudate or hydroxyl ions. The isolated nature of the Top Off solution makes it most easily maintained?

Q: What if EC is going up?

A: This is generally an indication that the running EC is slightly too high. Consider reducing target EC by 10-15% until EC trends downward and pH upward.

Q: If EC is dropping too quickly and my pH is rising more than 0.2 per day, what should be done?

A: Consider raising EC by 10-15% until the EC drops and pH is back to a slow rise. The proper mineral ratios will act to stabilize the solution.

Q: What if EC is rising but pH is dropping?

A: This may be an indication there is microbiological growth in the system. This would be a good time to run a full or partial change out of the solution to reduce potential issues and reset the solution.

- Hypochlorous Acid in the Nutrient Solution

Q: Why is Hypochlorous Acid important to run in an RDWC system?

A: Hypochlorous Acid diminishes the ionic bond, keeping minerals in solution highly solubilized, reducing the build up of films on plastic pipes, module walls and root tissue.

Q: How can I make sure I have the right amount of UC Roots in solution while my system is running?

A: Generally speaking, the active ingredient of UC Roots, Hypochlorous Acid, will diminish over a period of days in an aerated solution. In instances where water temps are above 70F, it may be useful to reintroduce UC Roots back into solution between system change outs. In this case, add back 1-2mLs per gallon.

Q: What is ORP?

A: Oxidation reduction potential, or ORP, is a measure of a substance's ability to either oxidize or reduce another substance. It is measured by the electrodes of an ORP meter. A positive reading on an ORP meter means that the substance is an oxidizing agent; a negative reading indicates that the substance is a reducing agent.

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Q: Is there a recommended ORP level for the UC System?

A:
Minimum - 200mV
Optimal Range - 250-350mV
Maximum - 400mV (crop damage may occur above this range)

Q: What role does Dissolved Oxygen play in the UC System?

A: Dissolved oxygen (DO) is required for plant respiration and rootzone function, both of which influence. nutrient uptake. Low oxygen levels encourage harmful anaerobic organisms that contribute to root rot (e.g. Pythium and Fusarium).

- Compatible Nutrients for UC Systems

Q: What type of nutrient is best suited for use in the UC System?

A: Highly water soluble mineral salt nutrients are the only choice for use in RDWC. The use of clean , pH stable fertilizers in the UC System results in supreme results and more functional system performance.

Avoiding crude salts or humate based fertilizers will eliminate the need for constant system monitoring and adjustments. As well, using clean, water soluble mineral salt nutrients will help avoid over involved cleaning practices necessitated when using lower quality fertilizers.

Current Culture H2O's proprietary fertilizer line, Cultured Solutions has proven itself to be the cleanest, most soluble plant nutrient in the industry. Aside from running exceptionally clean, Cultured Solutions is preferred by cultivators around the world for consistently producing the purest, most terpene rich flowers on the market.

- Organics and Low Solubility Products in Solution

Q: Can organic inputs such as humic acid, enzymes,c carbohydrates and inoculants be used in the UC System?

A: No. Organic inputs such as humic acid, enzymes, carbohydrates and inoculants used in the UC System tend to create biofilms and de-stabilize water chemistry, leading to issues with crop health and potentially outbreaks of pathogens within the system.

Current Culture H2O recommends against the use of humic acid, enzymes, carbohydrates and inoculants.

Though there a wide range of effective products on the market labeled as suitable for "hydroponics", RDWC has a very specific methodology that need be adhered to for success. Deposits of lignin based humates, or other organic acid tend to create water chemistry chaos and destabilize the nutrient solution.

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- IPM in an RDWC Nutrient Solution

Q: Does CCH2O have any rootzone IPM recommendations?

A: Yes. Cultured Solutions includes the use of Mycostop Biofungicide in the feed charts to address any potential for pathogen pressures. Contact tech@cch2o.com for usage details.

Q: Mycostop is an inoculant, isn't this recommended against by CCH2O to add to the UC System?

A: Mycostop is a very specific bacteria carried in a minimal inert powder which is proven uniquely compatible with RDWC applications.

Q: Can this be used with UC Roots?

A: Yes. Mycostop Biofungicide is compatible with UC Roots and Clear Line at CCH2O's recommended usage rates.

Q: Can systemic pesticides be used in the UC system?

A: CCH2O recommends against adding anything other than hypochlorous acid, mineral nutrients or Mycostop Fungicide into the UC System. Adding pesticides can disrupt water chemistry and prove harmful to plant health.

- Periodic Flushing of Nutrient Solution

Q: Is it necessary to flush out the system during the cropping cycle?

A: No. When operated properly, there is no build up of salts or compounds that would necessitate a flush. And because the UC System contains no absorbent substrate, there is no need to leach away any accumulating contaminants.

Q: When is a flush cycle necessary?

A: The only recommended flush is at the end of the cropping cycle, which is only for a 2-3 day period. This short flush period is due again to the fact that there is no substrate to flush, meaning plants nutrition begins to deplete immediately leading to hastened maturation.

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- Nutrient Solution Change Outs

Q: How often should a change out take place?

A: CCH2O recommends a nutrient solution changeout be performed every 7 days. This 7 day cycle corresponds with contemporary weekly feed schedules affording the solution chemistry to stay in step with feeding schedule recommendations.

Q: Should the entire system volume be drained and replaced when executing a change out?

A: Generally no.

Instead CCH2O recommends a 50% of the total system capacity be drained and replaced depending on the details. This partial change affords a stabilized solution remain, while the refreshed solution is topped off back into the system.

The partial change out conserves solution as well as allows for a more rapid transaction to minimize plant root exposure while the nutrient change is taking place.

Alternatively to a 50% changeout, it may be possible or necessary to change out a different % based on the condition of the nutrient solution.

Q: What dictates the need for the differing % change outs?

A: There are a number of variables to consider when considering the % of solution to be drained and replaced. Below are general considerations per each %.

25% (CCH2O Recommended)
- Solution chemistry is stable within range and plants are growing well.
- Generally appropriate for the flower cycle to keep in step with the feed chart.

50% (CCH2O Recommended)
- Solution chemistry is stable within range and plants are growing well.
- Generally appropriate for the flower cycle to keep in step with the feed chart.
- Suitable as a standard for establishing a repeatable SOP at scale.

75%
- Solution chemistry is unstable out of range and plants are showing signs of stress.
- Generally appropriate for transition from veg to flower when base nutrient changes.
- In the event solution begins to foul due to anomalous event such as poorly executed pH correction, addition of incompatible input, etc.

100%
- **Only executed at the end of the cropping cycle as a part of the cleaning process.**

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Q: When is a nutrient change out necessary before a 7 day period has passed?

A: Generally, if the nutrient solution becomes unstable and pH is rising or falling rapidly (over 0.2 swing per day) a partial change out is recommended.

Q: What are influencing factors for establishing a healthy UC System and operational rhythm?

A: Operating an efficient, highly productive RDWC system relies heavily on a properly balanced, well maintained nutrient solution. Generally hydroponic plants respond well in nutrient solutions that are allowed to stabilize and reach a balanced state of homeostasis.

Once the solution reaches this stable state, it is recommended to execute nutrient change outs as infrequently as possible. Meaning, unless there is a reason to exchange the solution, the system should be replenished via Top Off alone.

Q: Is it possible that a nutrient change out could be eliminated from the operating process?

A: When operated properly, healthy plants will be uptaking solution and transferring H2O into the environment via evapotranspiration. This process itself works to exchange the solution from the system, reducing the system's volume, prompting replenishment via Top Off Tank or fertigation.

In most instances, this process alone is sufficient to exchange and renew the solution enough to maintain a healthy water chemistry. But if the solution becomes imbalanced, draining away system volume and renewing with fresh solution can be a useful process.

Nutrient solution change outs aid in purging roots exudates from the solution, while replenishing macro and micro nutrients.

Q: Is there a preferred time to execute a nutrient change out?

A: To minimize stress on crops, perform this nutrient change out during the crop's night cycle, or in the beginning of the lights on cycle.

Q: What are the basic steps for executing a nutrient change out?

A:

1. In a Top Off tank, prepare a balanced solution to be topped back into the system. This should be made up based on the feed chart recommendation for the week the crop is moving into.
2. Using the circulation pump on the UC System, drain away 50% of the system volume.
3. Using a booster pump connected to the mixing tank, transfer the contents of the balanced tank into the UC System until desired fill level is achieved.

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- Draining and filling UC System For Change Out Cycle

Q: Should the recirculation pump be used for draining the system for a change out?

A: Depends on application. For smaller residential applications with one system this is acceptable, though not ideal. It is possible to connect unique plumbing to redirect solution being pumped to the epicenter away into a drain.

A better approach involves the use of a transfer pump connected to the drain out kit on the system. With this approach a self priming booster pump is plumbed directly to the system (or array of systems) that pumps the solution out of the systems to a reclaim or drain (depending on regulations and/or preference).

For larger systems it is recommended to tie the DOK into the return line for a more efficient, uniform draining of the system. This approach draws the nutrient solution from two points in the system leading to a much more effective means of drain out, especially with larger applications.

Contact tech@cch2o.com to learn more about this approach.

Q: If operating more than one system in an area, is it possible to plumb systems together to streamline the draining and filling process.

A: Yes. The implementation of trunk lines can be used to create plumbing that connects numerous systems to one transfer pump for draining and another trunk line for supply to fill systems. Contact tech@cch2o.com to learn more about this approach.

- Draining System End of Cycle

Q: Should the recirculation pump be used for draining the system?

A: No. A transfer pump connected to the drain out kit on the system is the correct approach. With this application a self priming booster pump is plumbed directly to the system (or array of systems) that pumps the solution out of the systems to a reclaim or drain (depending on regulations and/or preference).

Q: What should be done before initiating the drain cycle, and what is the basic process?

A: Before beginning the final drain cycle, be sure the primary recirculation pump for the system is unplugged to avoid damaging the pump.

1. Connect transfer pump to drain out kit.
2. Assure outlet from the transfer pump is terminated in the intended drain area. Depending on the application, the point of delivery will either be a drain or a recollection tank for post filtration.
3. Initiate transfer pump to begin draining the system. As the system drains, there will be air pulled through the pump which causes surging and pulses of water being evacuated. Self Priming transfer pumps are designed for this type of application and will continue to operate until system is drained.

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4. To allow for simple drain to waste during internal clean and rinsing, it is best to allow the system to gravity flow to a drain. In this application, allow the drain to stay open, allowing water to exit the system via gravity for ease of use.

Q: Is this process the same for all size systems?

For larger systems it is recommended to tying the DOK into the return line for a more efficient, uniform draining of the system. This approach draws the nutrient solution from two points in the system leading to a much more effective means of drain out, especially with larger applications.

Contact tech@cch2o.com to learn more about this approach.

Q: If operating more than one system in an area, is it possible to plumb systems together to streamline the draining and filling process.

A: Yes. The implementation of trunk lines can be used to create plumbing that connects numerous systems to one transfer pump for draining and another trunk line for supply to fill systems.

Contact tech@cch2o.com to learn more about this approach.

- Post-Harvest Cleaning & Sanitization

Q: Does the UC System need to be taken apart to clean after every cycle?

A: No, CCH2O recommends a CIP (clean in place) approach and has a detailed SOP for reference upon request. This approach is preferred as it improves contact of cleaning agents into all parts of the system for a more thoroug cleaning, as well as necessitating less labor.

Contact tech@cch2o.com for details.

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Post-Harvest Under Current® System CIP (Clean In Place) Sanitization SOP

The CIP process is the most effective means of sanitizing the Under Current System. Sanitization utilizing an aqueous cleaning solution allows for thorough internal cleaning within plumbing, while reducing labor and necessary down time. By utilizing a CIP strategy, the Under Current does not require full disassembly during the sanitization process.

Recommended Products

- BioSafe SaniDate 5.0 is a Hazardous Material --- most cost effective for commercial applications.
  -OR-
- BioSafe ZeroTol 2.0 is a Hazardous Material --- appropriate for commercial applications.
  -OR-
- BioSafe ZeroTol HC is a Non-Hazardous Material --- appropriate for residential applications.
- BioSafe GreenClean Acid Cleaner (OPTIONAL --- for aggressive internal cleaning) is a Hazardous Material - recommended for ccommercial applications only.
  - For systems that have been exposed to more severe conditions, with elevated build up, a more intensive cleaning practice may be necessary. In this instance, the use of Biosafe GreenClean Acid Cleaner is recommended.
  - See additional process sheet at the end of this SOP for reference.
  - **Requires the handling of Hazardous Materials**

Recommended Equipment

- Personal Protective Equipment (PPE)
  - Always use the appropriate PPE, for detailed recommendations, consult the BioSafe website @biosafesystems.com
  - IE. Chemical resistant gloves, eye protection, etc.
- Sponge and Towel (non-abrasive)
  - Scratching plastic surfaces increases the potential for microbial associated issues to develop. Do not use abrasive cleaners pads or cleaners.
- Pump Sprayer (recommended/optional)
- Portable Foamer (recommended/optional)
- Pressure Washer (optional)
- Shop Vac (highly recommended)

Environmental Considerations

- To reduce the accumulation of potentially harmful VOC's, be sure to maintain a well-ventilated area always.

Under Current® System - Internal Cleaning Process

1. Remove plants, root masses, and all debris from the system.
   a. Avoid dropping any additional biomass into the solution as this will make cleaning more difficult and may contribute to potential issues.
2. Remove lids and net pots, set aside for additional sanitization protocol (listed below).
3. With air pump(s) running, pull air stones from the system and set aside for separate disinfection process.
   a. Do not turn off air pump before removing air stones as this may result in a siphon action. This action will pull solution and ddebris into air stones causing potential issues.
4. Once all air stones have been removed, turn off the air pump(s).
5. Drain away solution volume down to a level just above the bulkheads. Be sure tops of the bulkheads are submersed to ensure ccontact with sanitation solution.
6. Add the recommended volume of SaniDate 5.0, Zerotol 2.0 or HC concentrate (see below) at multiple points throughout the system. Allow to circulate for 30 minutes to homogenize Zerotol into solution.

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Recommended dosage:

SaniDate 5.0	38 mL/gal (1 : 100 ratio)
ZeroTol 2.0	76 mL/gal (1 : 50 ratio)
ZeroTol HC	108 mL/gal (1 : 35 ratio)

7. Turn off circulation pump, let solution sit for 4-6 hours.
   a. For the sanitizing solution to be effective, it should be left to rest. Circulating the solution will reduce the effectiveness of the chemical reactions that remove films and residue.
8. After the sitting period, use a non-abrasive cloth or sponge to wipe down the insides of the modules above the water line as needed to loosen any debris.
9. Using a stream of clean water, rinse the residual into the sanitizing solution.
10. Drain the system completely via drain out plumbing.
11. Fill system back up with clean water to just above the bulkheads and allow to circulate for 30 minutes.
12. Drain out system contents. Fully evacuate the remaining contents by removing the caps on the end of all drain out lines.

**This non-toxic sanitization solution can be sent down municipal drains. Solution breaks down into oxygen and water.

Under Current® System - External Sanitizing Process

1. Clean/remove all loose debris and organic matter.
2. Prepare a dilute sanitizing solution using SaniDate 5.0, Zerotol 2.0 or HC with the recommended dosage:

SaniDate 5.0	9.5 mL/gal (1 : 400 ratio)
ZeroTol 2.0	25 mL/gal (1 : 150 ratio)
ZeroTol HC	38 mL/gal (1 : 100 ratio)

3. Using a pump sprayer or foamer apply sanitizing solution to the outside of modules and all connective plumbing.
   a. If cleaning system in a water sensitive area, use a damp cloth to perform this process.
4. Allow solution to rest for 15-30 minutes.
5. Using a non-abrasive damp cloth, wipe down outside of growth modules, water hoses, epicenter and adjacent plumbing if untouched by spray application.
6. Allow system to air dry.
7. Process complete, the system is now ready for use.

CCH2O Lid and Net Pot Sanitization

1. Remove plants, root masses, and all debris completely from net pots.
2. Fill a large soaking chamber with water.
3. Add SaniDate 5.0, ZeroTol 2.0 or HC at the recommended dosage:

SaniDate 5.0 - 38 mL/gal (1 : 100 ratio)

ZeroTol 2.0 - 76 mL/gal (1 : 50 ratio)

ZeroTol HC --- 150 mL/gal (1 : 25 ratio)

SaniDate 5.0	38 mL/gal (1 : 100 ratio)
ZeroTol 2.0	76 mL/gal (1 : 50 ratio)
ZeroTol HC	150 mL/gal (1 : 25 ratio)

4. Allow lids and net pots to soak for 4-6 hours.
5. Allow to air dry or wipe down with a damp cloth as needed.

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Air Stone Sanitization

This process is for intended for use on sintered air stones only. DO NOT USE this process on UC Comm Aqua Pore air diffusers!

SaniDate/ZeroTol will damage porous membrane of Aqua Pore diffuser. Please contact tech@cch2o.com for specific instructions.

1. With air pumps running, remove air stones from 1/4" air lines.
2. Fill large tub (large enough to fit desired contents) with water.
3. Add SaniDate 5.0, ZeroTol 2.0 or HC at the recommended dosage:

SaniDate 5.0	38 mL/gal (1 : 100 ratio)
ZeroTol 2.0	76 mL/gal (1 : 50 ratio)
ZeroTol HC	108 mL/gal (1 : 35 ratio)

4. Allow air stones to soak for 4-6 hours.
5. Allow to air dry completely before being reused (60+ days recommended).
    a. To facilitate this process, a secondary set of air stones is recommended to allow for cycled rotation.

Floor & Wall Sanitization

1. Sweep or vac away all plant debris.
2. Fill pump sprayer or foamer with water.
3. Add SaniDate 5.0, ZeroTol 2.0 or HC at the recommended dosage:

SaniDate 5.0 - 9.5 mL/gal (1 : 400 ratio)
ZeroTol 2.0 --- 25 mL/gal (1 : 150 ratio)
ZeroTol HC --- 38 mL/gal (1 : 100 ratio)

SaniDate 5.0	9.5 mL/gal (1 : 400 ratio)
ZeroTol 2.0	25 mL/gal (1 : 150 ratio)
ZeroTol HC	38 mL/gal (1 : 100 ratio)

4. *For foamer --- add BioFoamer foaming agent at 4 oz. per gallon.
5. Spray all floors, walls and surfaces.
6. Allow to solution to sit for 15-30 minutes.
7. Allow to air dry.

After use, this non-toxic sanitization solution can be sent down municipal drains. Solution breaks down into oxygen and water.

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Under Current® System - *Aggressive* Internal Cleaning Process

1. Remove plants, root masses, and all debris from the system.
   a. Avoid dropping any additional biomass into the solution as this will make cleaning more difficult and may contribute to potential issues.
2. Remove lids and net pots, set aside for additional sanitization protocol (listed above).
3. With air pump(s) running, pull air stones from the system and set aside for separate disinfection process.
   a. Do not turn off air pump before removing air stones as this may result in a siphon action. This action will pull solution and debris into air stones causing potential issues.
4. Once all air stones have been removed, turn off the air pump(s).
5. Drain away solution volume down to a level just above the bulkheads. Be sure tops of the bulkheads are submersed to ensure ccontact with sanitation solution.
6. Add the recommended volume of BioSafe GreenClean Acid Cleaner concentrate at multiple points throughout the system. Allow to circulate for 30 minutes to homogenize into solution.

Recommended dosage:
GreenClean Acid Cleaner - 38 mL/gal (1 : 100 ratio)

Recommended dosage:

GreenClean Acid Cleaner	38 mL/gal (1 : 100 ratio)

7. Turn off circulation pump, let solution sit for 30 min -1 hour.
   a. For the GreenClean Acid Cleaner solution to be effective, it should be left to rest. Circulating the solution will reduce the eeffectiveness of the chemical reactions that remove films and residue.
8. Drain the system completely via drain out plumbing.
9. Fill system back up with clean water to just above the bulkheads and allow to circulate for 30 minutes.
6. Add the recommended volume of ZeroTol 2.0 concentrate at multiple points throughout the system.

Recommended dosage:
SaniDate 5.0 - 38 mL/gal (1 : 100 ratio)
ZeroTol 2.0 - 76 mL/gal (1 : 50 ratio)

Recommended dosage:

SaniDate 5.0	38 mL/gal (1 : 100 ratio)
ZeroTol 2.0	76 mL/gal (1 : 50 ratio)

7. Turn pump back on and allow to circulate for 30 minutes to homogenize ZeroTol 2.0 into solution.
8. Turn off circulation pump, let solution sit for 12-18 hours.
   a. For the Zerotol solution to be effective, it should be left at rest. Circulating the solution will reduce the effectiveness of the chemical reactions that remove films and residue.
9. After the sitting period, use a non-abrasive cloth or sponge to wipe down the insides of the modules above the water line as needed to loosen any debris.
10. Using a stream of clean water, rinse the residual into the sanitizing solution.
11. Drain the system completely via drain out plumbing.
12. Fill system back up with clean water to just above the bulkheads and allow to circulate for 30 minutes.
13. Drain out system contents and wet vac away any remaining solution as needed.
14. Proceed with Under Current® System - External Cleaning Process listed above.

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CCH2O - HYDROPONICS WEEKLEY LOG

Under Current Weekly Log							
Room #/Name:							
System #/Name:							
Stage of Growth:	Clone | Mother | Veg | Flower						
Week:	_____ of _____						
Variety/Strain:							
Light On (time):							
Lights Off (time):							
Date	___/___/_____	___/___/_____	___/___/_____	___/___/_____	___/___/_____	___/___/_____	___/___/_____
Day	M T W T F S S	M T W T F S S	M T W T F S S	M T W T F S S	M T W T F S S	M T W T F S S	M T W T F S S
Time							
Nutrient Solution							
pH							
EC							
Water Temp							
ORP							
DO							
System Parameters							
Aeration Level (IWC)							
Water Level (%)							
Water consumed/added (gal)							
Air Pump Function (Y/N)							
Water Pump Function (Y/N)							
Inline Filter Check							
Environment							
Leaf Surface Temp							
Ambient Temp							
Humidity							
VPD							
CO2							
Light Levels							
Plant Care							
Root Health							
Root Pruning							
Foliar Applications							
Nutrient Adjustments/Additions							
Additional Adjustemnts Made							
Observations/Notes							

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Current Culture H2O - General Environmental Recommendations

4 Week Veg														
Weeks →Cycle	Veg Week 1	Veg Week 2	Veg Week 3	Veg Week 4	Bloom Week 1	Bloom Week 2	Bloom Week 3	Bloom Week 4	Bloom Week 5	Bloom Week 6	Bloom Week 7	Bloom Week 8	3 to 7-Day Flush	
Temp - Day (F°)	86°	84°	82°	80°	79°	79°	78	77	76	76°	75	75	70°	
Temp - Night (F°)	70°	70	70°	69°	69°	69°	68°	68°	68°	67°	66	65	63	
Relative Humidity - Day	75%	75%	70%	70%	65%	65%	65%	63%	61%	60%	60%	50%	40%	
Relative Humidity - Nigh	60%	60%	60%	60%	60%	60%	58%	58%	58%	56%	56%	54%	50%	
VPD - Day (kPa)	1/1.1	1/1.1	1/1.1	1.1/1.2	1.2	1.2	1.15/1.2	1.2	1.2	1.2/1.3	1.2/1.3	1.4/1.5	1.5	
VPD - Night (kPa)	1	1	1	1	1	1	1	1	1	1	1	1	1	
CO2 (ppm)	1500	1500	1500	1400	1350	1350	1250	1200	1100	1000	900	800	500	
PPFD µmol/m²/s	300-600	300-600	300-600	300-600	600-900	600-900	600-900	600-900	600-900	600-900	600-900	600-900	600-900	

Weeks →Cycle	Veg Week 1	Veg Week 2	Veg Week 3	Veg Week 4	Bloom Week 1	Bloom Week 2	Bloom Week 3	Bloom Week 4	Bloom Week 5	Bloom Week 6	Bloom Week 7	Bloom Week 8	Bloom Week 9	3 to 7-Day Flush
Temp - Day (F°)	86°	84°	82°	80°	79°	79°	78	77	76	76	76°	75	75	70°
Temp - Night (F°)	70°	70	70°	69°	69°	69°	68°	68°	68°	68°	67°	66	65	63
Relative Humidity - Day	75%	75%	70%	70%	65%	65%	65%	63%	61%	61%	60%	60%	50%	40%
Relative Humidity - Nigh	60%	60%	60%	60%	60%	60%	58%	58%	58%	58%	56%	56%	54%	50%
VPD - Day (kPa)	1/1.1	1/1.1	1/1.1	1.1/1.2	1.2	1.2	1.15/1.2	1.2	1.2	1.2	1.2/1.3	1.2/1.3	1.4/1.5	1.5
VPD - Night (kPa)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CO2 (ppm)	1500	1500	1500	1400	1350	1350	1250	1200	1100	1100	1000	900	800	500
PPFD µmol/m²/s	300-600	300-600	300-600	300-600	600-900	600-900	600-900	600-900	600-900	600-900	600-900	600-900	600-900	600-900

Weeks →Cycle	Veg Week 1	Veg Week 2	Veg Week 3	Veg Week 4	Bloom Week 1	Bloom Week 2	Bloom Week 3	Bloom Week 4	Bloom Week 5	Bloom Week 6	Bloom Week 7	Bloom Week 8	Bloom Week 9	Bloom Week 10
Temp - Day (F°)	86°	84°	82°	80°	79°	79°	78	77	76	76	76	76°	75	75
Temp - Night (F°)	70°	70	70°	69°	69°	69°	68°	68°	68°	68°	68°	67°	66	65
Relative Humidity - Day	75%	75%	70%	70%	65%	65%	65%	63%	61%	61%	61%	60%	60%	50%
Relative Humidity - Nigh	60%	60%	60%	60%	60%	60%	58%	58%	58%	58%	58%	56%	56%	54%
VPD - Day (kPa)	1/1.1	1/1.1	1/1.1	1.1/1.2	1.2	1.2	1.15/1.2	1.2	1.2	1.2	1.2	1.2/1.3	1.2/1.3	1.4/1.5
VPD - Night (kPa)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CO2 (ppm)	1500	1500	1500	1400	1350	1350	1250	1200	1100	1100	1100	1000	900	800
PPFD µmol/m²/s	300-600	300-600	300-600	300-600	600-900	600-900	600-900	600-900	600-900	600-900	600-900	600-900	600-900	600-900

3 Week Veg														
Weeks →Cycle	Veg Week 1	Veg Week 2	Veg Week 3	Bloom Week 1	Bloom Week 2	Bloom Week 3	Bloom Week 4	Bloom Week 5	Bloom Week 6	Bloom Week 7	Bloom Week 8	3 to 7-Day Flush		
Temp - Day (F°)	86°	84°	82°	79°	79°	78	77	76	76°	75	75	70°		
Temp - Night (F°)	70°	70	70°	69°	69°	68°	68°	68°	67°	66	65	63		
Relative Humidity - Day	75%	75%	70%	65%	65%	65%	63%	61%	60%	60%	50%	40%		
Relative Humidity - Nigh	60%	60%	60%	60%	60%	58%	58%	58%	56%	56%	54%	50%		
VPD - Day (kPa)	1/1.1	1/1.1	1/1.1	1.2	1.2	1.15/1.2	1.2	1.2	1.2/1.3	1.2/1.3	1.4/1.5	1.5		
VPD - Night (kPa)	1	1	1	1	1	1	1	1	1	1	1	1		
CO2 (ppm)	1500	1500	1500	1350	1350	1250	1200	1100	1000	900	800	500		
PPFD µmol/m²/s	300-600	300-600	300-600	600-900	600-900	600-900	600-900	600-900	600-900	600-900	600-900	600-900		

Weeks →Cycle	Veg Week 1	Veg Week 2	Veg Week 3	Bloom Week 1	Bloom Week 2	Bloom Week 3	Bloom Week 4	Bloom Week 5	Bloom Week 6	Bloom Week 7	Bloom Week 8	Bloom Week 9	3 to 7-Day Flush
Temp - Day (F°)	86°	84°	82°	79°	79°	78	77	76	76	76°	75	75	70°
Temp - Night (F°)	70°	70	70°	69°	69°	68°	68°	68°	68°	67°	66	65	63
Relative Humidity - Day	75%	75%	70%	65%	65%	65%	63%	61%	61%	60%	60%	50%	40%
Relative Humidity - Nigh	60%	60%	60%	60%	60%	58%	58%	58%	58%	56%	56%	54%	50%
VPD - Day (kPa)	1/1.1	1/1.1	1/1.1	1.2	1.2	1.15/1.2	1.2	1.2	1.2	1.2/1.3	1.2/1.3	1.4/1.5	1.5

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CCH2O - ENVIRONMENTAL RECOMMENDATIONS

VPD - Night (kPa)	1	1	1	1	1	1	1	1	1	1	1	1	1	
CO2 (ppm)	1500	1500	1500	1350	1350	1250	1200	1100	1100	1000	900	800	500	
PPFD µmol/m²/s	300-600	300-600	300-600	600-900	600-900	600-900	600-900	600-900	600-900	600-900	600-900	600-900	600-900	
Weeks →Cycle	Veg Week 1	Veg Week 2	Veg Week 3	Bloom Week 1	Bloom Week 2	Bloom Week 3	Bloom Week 4	Bloom Week 5	Bloom Week 6	Bloom Week 7	Bloom Week 8	Bloom Week 9	Bloom Week 10	3 to 7-Day Flush
Temp - Day (F°)	86°	84°	82°	79°	79°	78	77	76	76	76	76°	75	75	70°
Temp - Night (F°)	70°	70	70°	69°	69°	68°	68°	68°	68°	68°	67°	66	65	63
Relative Humidity - Day	75%	75%	70%	65%	65%	65%	63%	61%	61%	61%	60%	60%	50%	40%
Relative Humidity - Nigh	60%	60%	60%	60%	60%	58%	58%	58%	58%	58%	56%	56%	54%	50%
VPD - Day (kPa)	1/1.1	1/1.1	1/1.1	1.2	1.2	1.15/1.2	1.2	1.2	1.2	1.2	1.2/1.3	1.2/1.3	1.4/1.5	1.5
VPD - Night (kPa)	1	1	1	1	1	1	1	1	1	1	1	1	1	1
CO2 (ppm)	1500	1500	1500	1350	1350	1250	1200	1100	1100	1100	1000	900	800	500
PPFD µmol/m²/s	300-600	300-600	300-600	600-900	600-900	600-900	600-900	600-900	600-900	600-900	600-900	600-900	600-900	600-900
2 Week Veg														
Weeks →Cycle	Veg Week 1	Veg Week 2	Bloom Week 1	Bloom Week 2	Bloom Week 3	Bloom Week 4	Bloom Week 5	Bloom Week 6	Bloom Week 7	Bloom Week 8	3 to 7-Day Flush			
Temp - Day (F°)	86°	84°	79°	79°	78	77	76	76°	75	75	70°			
Temp - Night (F°)	70°	70	69°	69°	68°	68°	68°	67°	66	65	63			
Relative Humidity - Day	75%	75%	65%	65%	65%	63%	61%	60%	60%	50%	40%			
Relative Humidity - Nigh	60%	60%	60%	60%	58%	58%	58%	56%	56%	54%	50%			
VPD - Day (kPa)	1/1.1	1/1.1	1.2	1.2	1.15/1.2	1.2	1.2	1.2/1.3	1.2/1.3	1.4/1.5	1.5			
VPD - Night (kPa)	1	1	1	1	1	1	1	1	1	1	1			
CO2 (ppm)	1500	1500	1350	1350	1250	1200	1100	1000	900	800	500			
PPFD µmol/m²/s	300-600	300-600	600-900	600-900	600-900	600-900	600-900	600-900	600-900	600-900	600-900			
Weeks →Cycle	Veg Week 1	Veg Week 2	Bloom Week 1	Bloom Week 2	Bloom Week 3	Bloom Week 4	Bloom Week 5	Bloom Week 6	Bloom Week 7	Bloom Week 8	Bloom Week 9	3 to 7-Day Flush		
Temp - Day (F°)	86°	84°	79°	79°	78	77	76	76	76°	75	75	70°		
Temp - Night (F°)	70°	70	69°	69°	68°	68°	68°	68°	67°	66	65	63		
Relative Humidity - Day	75%	75%	65%	65%	65%	63%	61%	61%	60%	60%	50%	40%		
Relative Humidity - Nigh	60%	60%	60%	60%	58%	58%	58%	58%	56%	56%	54%	50%		
VPD - Day (kPa)	1/1.1	1/1.1	1.2	1.2	1.15/1.2	1.2	1.2	1.2	1.2/1.3	1.2/1.3	1.4/1.5	1.5		
VPD - Night (kPa)	1	1	1	1	1	1	1	1	1	1	1	1		
CO2 (ppm)	1500	1500	1350	1350	1250	1200	1100	1100	1000	900	800	500		
PPFD µmol/m²/s	300-600	300-600	600-900	600-900	600-900	600-900	600-900	600-900	600-900	600-900	600-900	600-900		
Weeks →Cycle	Veg Week 1	Veg Week 2	Bloom Week 1	Bloom Week 2	Bloom Week 3	Bloom Week 4	Bloom Week 5	Bloom Week 6	Bloom Week 7	Bloom Week 8	Bloom Week 9	Bloom Week 10	3 to 7-Day Flush	
Temp - Day (F°)	86°	84°	79°	79°	78	77	76	76	76	76°	75	75	70°	
Temp - Night (F°)	70°	70	69°	69°	68°	68°	68°	68°	68°	67°	66	65	63	
Relative Humidity - Day	75%	75%	65%	65%	65%	63%	61%	61%	61%	60%	60%	50%	40%	
Relative Humidity - Nigh	60%	60%	60%	60%	58%	58%	58%	58%	58%	56%	56%	54%	50%	
VPD - Day (kPa)	1/1.1	1/1.1	1.2	1.2	1.15/1.2	1.2	1.2	1.2	1.2	1.2/1.3	1.2/1.3	1.4/1.5	1.5	
VPD - Night (kPa)	1	1	1	1	1	1	1	1	1	1	1	1	1	
CO2 (ppm)	1500	1500	1350	1350	1250	1200	1100	1100	1100	1000	900	800	500	
PPFD µmol/m²/s	300-600	300-600	600-900	600-900	600-900	600-900	600-900	600-900	600-900	600-900	600-900	600-900	600-900	

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Mycostop Bio Fungicide

Usage Instructions
Storage:
Mycostop contains living dried ray bacteria belonging to the genus Streptomyces whose viability and capacity to control plant pathogens are best retained by storing the product at a temperature below 45°F in a refrigerator.

Mixing Technique:
The Mycostop powder needs to be added first into a small amount of water, e.g. 0.25-0.5 gallons, and this is then allowed to stand for about 30 minutes. This procedure enables the microbes to become activated and for the powder to thoroughly absorb water. After half an hour, the mixture needs to be stirred and only then is it ready to be diluted to the final volume.

Dilution Ratio:
Once opened, all contents of a package must be kept dry to avoid premature spoilage of the unused contents of Mycostop powder. This fine powder readily absorbs moisture, take measures to avoid introducing moisture while decanting. Assuming the powder remains dry, it can be stored in the refrigerator for up to 90 days.

- 5 Gram – Treats up to 500 gallons
- 25 Gram – Treats up to 2500 gallons

Mycostop General Recommendations

Mycostop can be used in conjunction with UC Roots or Clear Line Hypochlorous Acid.

Standard Preventative Application - add to UC System twice per month (ideally w/ nutrient change out)

- 1 gram Mycostop to 100 gallons purified water
- Re-administer after any high dose Hypochlorous Acid flush

First Signs of Root Issues - add to UC System

- 4 grams Mycostop to 100 gallons purified water
- 5 ml UC Roots per gallon purified water or 1mL per gallon of Clear Line

Infected Plant Dunk - dunk root mass and grow medium into solution

1. If necessary, remove dead or dying root material (sterilize scissors or scalpel between plants)
2. Dunk root mass and grow medium into UC Roots solution (100 ml per 10 gallons purified water) or Clear Line solution (20 ml per 10 gallons purified water) for 5 to 15 seconds
3. Dunk root mass and grow medium into Mycostop solution (1 gram per 10 gallons purified water) for 5 to 15 seconds
4. Place plant back into system with fresh nutrient solution change out
5. Add Standard Preventative Application to system

Preventative Root Dip – dunk root mass and grow medium into solution

- Before planting into UC system @ 2 grams Mycostop to 5 gallons purified water.

These are general recommendations. Please monitor your plants and use with discretion.

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CULTURED SOLUTIONS®

PREMIUM HYDROPONIC NUTRIENTS



Follow QR Link to CCH2O Website for Cultured Solutions Nutrient Calcutator

For specific usage questions or product details reach out to tech@cch2o.com

RECIRCULATING HYDRO

NORMAL STRENGTH

RDWC, DWC, Aeroponics, NFTT

PLANT STAGE	VEG				BLOOM								FLUSH
WEEK	1	2	3	4	1	2	3	4	5	6	7	8	2-3DAYS
CLEARLINE™	1	1	1	1	1	1	1	1	1	1	1	1	1-2
COCO CAL	2	2	2	2	2	2	2	2	2	2	2	2	
VEG A	0.5	1	2	2.5									
VEG B	0.5	1	2	2.5									
BLOOM A					3.5	4.5	6	6	7	6	4	3	
BLOOM B					3.5	4.5	6	6	7	6	4	3	
BUD BOOSTER					0.5	1.5	2	3	3.5	3	2	1.5	
MYCOSTOP™	Per 1 GRAM / 100 Gal		Per 1 GRAM / 100 Gal		Per 1 GRAM / 100 Gal		Per 1 GRAM / 100 Gal		Per 1 GRAM / 100 Gal		Per 1 GRAM / 100 Gal		
PPM 500	100	175	300	325	425	500	600	650	700	650	450	400	0-100
PPM 700	140	245	420	455	595	700	840	910	980	910	630	560	0-100
EC	0.2	0.3	0.6	0.6	0.8	0.8	1.2	1.3	1.4	1.2	0.9	0.8	0.1
pH	6	6	5.9	5.9	5.9	5.9	5.9	5.8	5.8	5.8	5.8	5.8	5.7
TEMP	68°	68°	68°	68°	68°	68°	68°	68°	68°	68°	68°	65°	62°
ORP	250-350	250-350	250-350	250-350	250-350	250-350	250-350	250-350	250-350	250-350	250-350	250-350	250-350
DO MINIMUM	8 mg/L	8 mg/L	8 mg/L	8 mg/L	8 mg/L	8 mg/L	8 mg/L	8 mg/L	8 mg/L	8 mg/L	8 mg/L	8 mg/L	8 mg/L

DRAIN TO WASTE

NORMAL STRENGTH

Coco Coir, Rockwool, Drip, SoillessS

PLANT STAGE	VEG				BLOOM								FLUSH
WEEK	1	2	3	4	1	2	3	4	5	6	7	8	2-3DAYS
CLEARLINE™	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	0.5	1-2
COCO CAL	3	3	3	3	3	3	3	3	3	3	3	3	
VEG A	4	4	6	6									
VEG B	4	4	6	6									
BLOOM A					8	8	9	9	9	8	4	3	
BLOOM B					8	8	9	9	9	8	4	3	
BUD BOOSTER							4	5	9	10	12	10	
PPM 500	450	450	600	600	800	800	1000	1050	1100	1050	1000	750	0-100
PPM 700	630	630	840	840	1120	1120	1400	1470	1540	1470	1050	700	0-100
EC	0.9	0.9	1.2	1.2	1.6	1.6	2	2.1	2.2	2.1	1.5	1	0.1
pH	6	6	5.9	5.9	5.9	5.9	5.9	5.8	5.8	5.8	5.8	5.8	5.7
TEMP	68°	68°	68°	68°	68°	68°	68°	68°	68°	68°	68°	65°	62°
ORP	350-400	350-400	350-400	350-400	350-400	350-400	350-400	350-400	350-400	350-400	350-400	350-400	350-400
DO MINIMUM	8 mg/L	8 mg/L	8 mg/L	8 mg/L	8 mg/L	8 mg/L	8 mg/L	8 mg/L	8 mg/L	8 mg/L	8 mg/L	8 mg/L	8 mg/L

-All recommendations are represented in Millileters Per Gallon

-Omit Mycostop if Regionally Unavailable

-Do not combine any products in undiluted form

-Use clean measuring instruments do not put anything into the bottle

-Store closed in original packaging at a temperature between 45°F and 85°F

mL/gal Injection Rate

1	1 : 3840
2	1 : 1920
3	1 : 1280
4	1: 960
5	1 : 770
6	1 : 640
7	1 : 550
8	1 : 480
9	1 :430
10	1 : 385

1 tsp	= 5mL
1 tbsp	= 15mL
1 oz	= 30 m
1 qt	= 946 m
1 gal	= 3.785
1 gal	= 120 o

GENERAL ENVIRONMENTAL TARGETS

PLANT GROWTH STAGE	VEG				BLOOM								FLUSH
Weeks	1	2	3	4	1	2	3	4	5	6	7	8	3 to 7 Day Flush
Temp - Day (F°)	86°	84°	82°	80°	79°	79°	78°	77°	76°	76°	75°	75°	70°
Temp - Night (F°)	70°	70°	70°	69°	69°	69°	68°	68°	68°	67°	66°	65°	63°
Relative Humidity - Day	75%	75%	70%	70%	65%	65%	65%	63%	63%	60%	60%	50%	50%
Relative Humidity - Night	60%	60%	60%	60%	60%	60%	58%	58%	58%	56%	56%	54%	50%
VPD - Day (kPa)	1/1.1	1/1.1	1/1.1	1.1/1.2	1.2	1.2	1.15/1.2	1.2	1.2	1.2/1.3	1.2/1.3	1.4/1.5	1.5
VPD - Night (kPa)	1	1	1	1	1	1	1	1	1	1	1	1	1
CO2 (ppm)	1500	1500	1500	1400	1350	1350	1250	1200	1100	1000	900	800	500
PPFD µmol/m²/s	300-600	300-600	300-600	300-600	600-900	600-900	600-900	600-900	600-900	600-900	600-900	600-900	600-900

Cultured Solutions - Liquid Hydroponic Fertilizers

Formulated For Performance. Clearly Superior Blends. Noticeably Better Results.

Cultured Solutions liquid fertilizers were originally developed for precision irrigation applications such as Aeroponics, RDWC, and pressure-compensated drip. These productive methods all require an exceptionally clean nutrient formulation to operate properly.

To meet the high standards necessary for these applications, formulations were developed and refined over the past decade, ultimately creating a liquid fertilizer line with unmatched clarity and stability. These resulting blends are recognized throughout the world as amongst the cleanest and most trusted for home gardening and professional cultivation.

Cultured Solutions blending processes have been painstakingly developed for over a decade to deliver unmatched clarity. Utilizing pure, high-temperature Reverse Osmosis water, mineral salts and chelates are combined for initial solubilization. This is followed by an extensive Triple Filtration Process that removes any impurities before moving on to bottling.

This carefully executed series of events produces the world's cleanest, most effective hydroponic fertilizers for Indoor CEA & Greenhouse crop production.

Refined Formulations

- Crystal Clear Liquid Blends
- Sterile, Free of Organic and Microbial Contaminants
- Free of Harmful PGR's, BPA's and Dyes

Quality Assured

- Extensive QC and Performed During Batching
- Refined Blending SOPs for Consistency
- Ultra Filtered Blends Deliver Predictable Results

Simple to Use

- No Pre-Mixing of Powders Required
- Compatible with All Fertigation Systems
- pH Stable, Remains Soluble in All Conditions



Cultured Solutions - Macro & Micro Base Fertilizers



COCO CAL

Calcium Magnesium Supplement

Cultured Solutions® COCO CAL is formulated to provide the ideal ratio of Calcium, Magnesium and Iron in solution. Designed for use in all phases of plant growth, Coco Cal ensures crops remain free of deficiencies and highly productive.



VEG A/B

2-Part Premium Vegetative Nutrient

Cultured Solutions® VEG A & B provides a clean, pH stable blend of primary and secondary minerals to encourage rapid vegetative growth. Formulated for applications ranging from field to greenhouse, Veg A & B deliver results.



BLOOM A/B

2-Part Premium Bloom Nutrient

Cultured Solutions® BLOOM A & B is a full spectrum, mineral based nutrient formulated to provide all the macro and micro nutrients required during reproductive growth and flowering. Blends are clean and sterile with no inclusion organic or microbial contents.



BUD BOOSTER

Supports Flower Formation

Cultured Solutions® BUD BOOSTER - Supplies Sulfur and Magnesium to assist in the synthesis of essential amino acids. This encourages the production of complex sugars and starches, crucial during fruit and flower formation.

*A*Available in Quart, Gallon, 5 Gallon, 15 gallon, 55 Gallon & 275 Gallon**



CLEAR LINE - High Concentration 1500ppm Hypochlorous Acid

Hydroponic & Drip System Descaler

Cultured Solutions Clear Line reduces mineral deposits in hydroponic systems, substrate and irrigation equipment. Ideal for DWC/RDWC, Rockwool, NFT, Ebb/ Flow, Drip and substrate based Re-circulating or Drain to Waste.

Keeps Irrigation Lines & Drip Emitters Free from Films & Mineral Build-Up

PREDICTABLE RESULTS

Reduces mineral build-up and biofilms in pressure compensating drip emitters, assuring precision delivery of the nutrient solution.

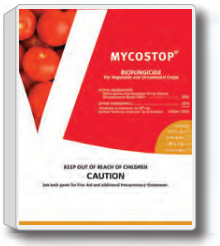
IMPROVE ROI

Increases the operational life span of irrigation plumbing saving money on maintenance and replacement equipment.

CROP CONSISTENCY

Ensures nutrient solution remains highly soluble, providing optimal availability for plant uptake.





MYCOSTOP™

Hydroponic Rootzone IPM

MYCOSTOP® contains a high concentration of Streptomyces K61, which is effective at combating a root fungus complex that causes damping off and dieback in plants: Fusarium and Pythium on a wide variety of crops.

HYDRO FROST
SOLUTION CHILLER

Engineered for hydroponic cultivation, Hydro Frost Solution Chillers provide precise temperature control for irrigation reservoirs and hydroponic systems. Utilizing commercial-grade components and solid-state electronics, Hydro Frost Solution Chillers offer performance and are built to last for years.

Hydro Frost Solution Chillers integrate seamlessly into a wide range of irrigation applications. These durable units provide a reliable solution for controlling nutrient solution temperatures, ensuring optimal crop performance.

High Efficiency
Designed to achieve the highest coefficient of performance (COP), contributing to significant energy savings.

Premium Construction
Galvanized steel housing with a durable powder coated finish. Industry leading components.

High-Performance Rotary Compressor
Extremely efficient and reliable. Internationally recognized and exclusively used in all units.

Titanium Coaxial Heat Exchanger
Ensures high performance with low energy consumption. Anti-corrosive for saltwater and freshwater applications.

Computer Intelligent
Microcomputer control system and LCD display. Auto restart and temperature memory in the event of a power failure.

Intuitive and Accurate Settings
Easy to operate, with real-time water temperature control and accurate temperature readings. Over current and overheat auto-protection system.

Decreased Noise Levels
High air volume and low noise design allow for quiet operation.

Minimal Maintenance
Designed for years of reliable use, serviceable with replacement components. 1-year warranty.







Hydro Frost Chiller Specifications			
Model No.	HF–2 HP	HF–3 HP	Available Q4 2024
Unit Dimensions	31 x 16 x 23 in.	31 x 16 x 27 in.	36 x 20 x 41 in.
Maximum Tank Size	400 gal. / 1514 Lt.	600 gal. / 2271 Lt.	1000 gal. / 3785 Lt.
Cooling Capacity	5,200W	7,200W	17,400W
Rated Voltage	220-230v /60HZ	220-230v /60HZ	208-230v/60HZ/3-Phase
Rated Power	2 HP (1550w)	3 HP (2400w)	5 HP(3700w)
Current	7.5A - 8.2A	11.2A - 12.5A	17.5A - 18.3A/Ph
Refrigerant	R410A	R410A	R410A
Recommended Flow Rate	>1189 Gal./H / 4,500 Lt.	>1320 Gal./H / 5,500 Lt.	>1717 Gal./H / 6,500 Lt.
Outlet / Inlet Size	1” in. (25.4 mm)	1.5” in. (38.1 mm)	2” in. (50 mm)
Weight	121 lbs. (55kg)	132 lbs. (60kg)	275 lbs. (125kg)
Maximum Operating Pressure	25 psi	25 psi	25 psi

Centralized Automated Dosing & Fertigation

FERTILIZER DOSING FOR THE CRAFT GROWER

- Volume Based Dosing: Simply enter the mL per gallon ratio and the number of gallons, and let the system handle the rest.

- EC Based Dosing for Each Part: The system confirms the EC for each part before adding the next, ensuring accurate and consistent dosing every time.

- Delay Between Parts: The system can add solutions like silica first, then waits 10 minutes for molecular bonds to form before adding additional nutrients.

FERTIGATION IN 3 SIMPLE STEPS

1) Fills Mixing Tank

Automatically fills the tank with a specific amount of freshwater.

2) Doses Liquid Fertilizers

Precisely adds the nutrients as desired.

3) Delivers to Rooms or Tanks

Sends the solution directly to plants or satellite tanks.



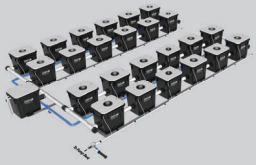
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Under Current Resource Guide

UNDER CURRENT®
HYDROPONIC SYSTEMS



CULTURED SOLUTIONS®
PREMIUM HYDROPONIC NUTRIENTS



HYDRO FROST
SOLUTION CHILLERS



HPAC Cloning System



See us in action
INSTAGRAM



CCH20
Retail Price List