

CropKing Greenhouse Package: NFT System

The Greenhouse Structure needs the strength to handle heavy snow loads and high winds. The roof structure members must be strong yet slender to allow the maximum amount of light and minimize the shading. CropKing uses high strength (50/55kpsi) galvanized “Gatorshield™” steel and custom aluminum extrusions to create a strong, cost effective, and long lasting frame that will survive in the high humidity of the greenhouse environment.

Gutter Connect Unit (can be expanded by adding additional 22’ wide bays) - Our frames are made of galvanized structural steel and the connecting gutter is made of extruded aluminum. When using the NFT (small leaf crop) growing system, we typically suggest that the gutters be at 8’, since the lettuce is growing at table height and does not need a lot of overhead height. We use QuickLock, a poly lock system for attaching the covers to the extruded aluminum gutters. The gutter support posts are on 8’ centers and the roof arches are on 4’ centers. Included are three purlins per bay, wind braces, connecting hardware, and an embossed steel clad entrance door with aluminum casing (one door for up to 4 bays). This structure is rated for a 20 pound snow load and 90 MPH wind load. With a gutter connected greenhouse, we suggest that you start with at least a two bay unit for structural integrity.

Pros:

- **Can be expanded as needed by adding on additional bays**
- **More energy efficient, with less outside walls per square foot**
- **Can share equipment such as computerized controls, fertroller, or injection systems with the other bays as it is all one structure**
- **Straight side walls make more efficient use of inside space**

Cons:

- **More involved construction process**
- **First 2 Bays are more costly per square foot than a Free-standing Unit**

Freestanding Unit- Gothic shape, has a peak in the center for added strength and snow load (12 lb snow load) and is rated for an 90 MPH wind load. The arches come in two pieces (with a center coupler) and are spaced on 4’ centers. They feature ground stakes and five purlins that run the full length of the greenhouse. Diagonal wind braces are used for bracing the end walls. All necessary connectors, hardware and brackets for attaching the end wall framing are included. Our entrance door is embossed steel clad with aluminum casing.

Pros:

- **Lower initial investment**
- **Easier to get started**
- **More simple to build**

Cons:

- **There are more outside walls, per square foot, resulting in more heat loss**
- **Is not expandable**



Greenhouse Covering CropKing greenhouses are covered with 6 mil greenhouse grade polyethylene plastic. Air is pumped between the two layers of plastic with inflation fans. The covers are fastened to the greenhouse using an aluminum extrusion. The pillow of air between the two layers of greenhouse plastic, provides insulation, rigidity (helps keep the plastic from flapping during windy weather) and also has an anti-condensation feature. The greenhouse plastic film has a coating for light diffraction which spreads the incoming light to eliminate shadows, and the inner layer has an IR blocking ability which helps to keep heating costs lower. While glass has higher light transmission than greenhouse plastic, once you consider the additional shading due to glazing bars and the additional structure to support the weight of the glass, the two systems provide similar net light transmission levels to the plants. There is a considerable cost differences between a glass house and a poly house and you can easily see why most commercial greenhouse structures are covered with poly. The South wall covering included in the greenhouse package is 8mm twin wall, UV resistant polycarbonate panels, the needed “H” and “U” channel to join the panels together, and Tek screw for fastening to the framework. Polycarbonate is strong, clear and impact resistant. It is also very easy to cut and install, and comes with a 10 year warranty. The greenhouse package does not include the North end wall covering and we recommend that this wall be insulated and sided with the customer’s choice of material.

Cooling System Keeping the plants at their ideal temperature and humidity is crucial to optimizing growth and controlling plant diseases. If the greenhouse were not equipped with a cooling system, during sunny days it would easily reach temperature in excess of 100°. Such high temperatures severely reduce crop quality and worker productivity. Because CropKing greenhouses are designed to grow year around, equipment is required to keep the greenhouse cool. Exhaust Fans in the north end of the greenhouse pull air from the back of the greenhouse across Evaporative Pads or a “wet wall”. This wall lowers the temperature of the incoming air. Evaporative cooling is a common and one of the most cost effective methods for reducing the temperature inside a greenhouse. While air conditioning or refrigeration systems can be used, their installation and operating costs are usually prohibitive. The greenhouse system includes exhaust fans and an evaporative pad system. A Glacier-Cor PVC open top evaporative wet wall pad with a self-contained water distribution system (so no sump tank is needed) is positioned on the *inside* of the south end of the house. The heavy duty greenhouse grade American Coolair fans include slant wall housings, fan guards, aluminum shutters, motors and all necessary hardware.

Power Vent Door When the exhaust fans come on in the North wall of the greenhouse, an automatic vent door opens to allow air to enter the greenhouse. The rack and pinion driven vent door on the South end of the greenhouse, the opposite end from the fans, will open when the fans are running and close securely when the fans are not running. It has a gear driven motor with limit switches and is covered with 8mm twin wall polycarbonate. The frame of the vent door is made of aluminum extrusions. The proportional opening and closing of Power Vent door is controlled by the iGrow 1400 environmental control system.

Air Circulation System Air Circulation is important for a healthy greenhouse environment. Air circulating through the foliage of a plant brings a much needed supply of fresh carbon dioxide to the plant. Good air circulation helps to prevent diseases that would start more easily in areas of stagnant air. The air Circulation System in the greenhouse consists of a motorized intake shutter with Jet Fan in the peak of the greenhouse. The unit heaters blow warm air into the heater diverter, providing uniform heat down the length of the greenhouse. A punched poly air tube is attached to the jet fan and runs the full length of the greenhouse to disperse the air evenly. The support wires and tube hangers for this air tube are included.

Overhead Unit Heater Each bay or unit includes two Modine PDP 80% efficient standard unit heaters (10 year limited warranty) with 180 degree rotating power exhauster and aluminized steel heat exchanger and burners. Galvanized steel heater hangers are included. ***For an additional charge, we suggest that in cold climates, one of the heaters can be replaced with a 93% efficient unit heater. While this Modine Effinity93 heater is more expensive, studies have shown that it can have a payback in less than two years in typical northern climates. Since only one of the heaters runs during the majority of the heating season, we recommend only upgrading one heater per bay.***

Computerized Environmental Controls The iGrow 1400 Control System is the brain of the greenhouse. This dedicated unit controls all the environmental equipment in the greenhouse such as fans, heaters, vent door, wet wall, lights and CO2. Due to the quickly changing environment of the greenhouse, specialized greenhouse controllers are critical to maintaining the correct plant environment. The computer controller measures both temperature and humidity of the greenhouse and adjusts the equipment to maintain the correct set points. By maintaining tight tolerances on the environment both night and day, significant energy savings can be achieved over simpler thermostat control. The iGrow Control System has onscreen programming for easy tracking and adjustment of the environment. There are 12 outputs with LED status display indicators and manual over-ride switches. With the addition of “slave units” the iGrow system can be expanded.

Electrical Panel For ease of installation, CropKing provides a pre-wired electrical panel that has been tailored to your greenhouse needs. Mounted on a white painted board is the breaker panel, a relay box, and the iGrow controller(s). All of these are pre-wired together and terminal strips are provided to connect the greenhouse equipment. This pre-wired panel makes installation much easier, with only a need to provide incoming power to the panel and then run wires from the terminal strips out to all the equipment. Since the computer controller only provides low power outputs, high amperage equipment such as motors and pumps need to be controlled with line voltage relays. The wiring for this system can be complicated and often misunderstood by the local electrician. CropKing simplifies all this with their prewired electrical panel. Our panels and boxes are interior grade NEMA enclosures as we find this appropriate for a hydroponic greenhouse operation. The power requirements of a greenhouse depend on the size of the greenhouse and whether grow lights are being installed. *Note: Please check with the local electric codes. While we use UL listed components in our electrical panels, some codes require the constructed panel be UL listed.*

Technical Support Technical support is a very important part of any CropKing Greenhouse System. Included is attendance to one of our Grower Training Workshop and a copy of the workshop on DVD for future referral. One of the most valuable features of our technical support package is the access to our techs with your specific questions. We suggest that you email weekly pictures of your crop or call into our office to discuss your growing concerns. We also include several books and DVDs based on your growing system. (i.e. *Lettuce Production Training DVD, Hydroponic Lettuce Production by Morgan*)

NFT Growing Systems The Nutrient Film Technique (NFT) is a growing system that constantly recirculates a continuous stream of water through food grade PVC which delivers nutrients to leaf crops such as lettuces and smaller herbs. The NFT channel system uses water very efficiently by the recirculation of the nutrient solution. A continuous stream of water flows through the food grade PVC channels and is returned to an underground tank that is under the growing beds. CropKing’s NFT System includes an extra nutrient feed pump as a back-up. While this is a costly pump, it is important to have a back up to the system in case of emergency. The NFT Growing Channel has “end caps” on both ends to keep light away from the nutrient solution. This is crucial because light and nutrient solution are the perfect environment for growing algae and algae will attract pests. The top caps are removable for ease of cleaning. The top covers are punched with 1” square holes on 8” centers. The seedlings spend the first 10-20 days in the nursery before being transplanted into the growing channel. The CropKing NFT Fertroller is an important piece of equipment in the NFT system. A Fertroller is continually sampling the solution in the underground tank to constantly monitor the pH and EC (level of fertilizer) and adjusts the nutrient solution to match the requirements of the plant.

NFT Lettuce System Components:

- **CropKing NFT Growing Channel:** 2 piece extruded PVC growing channels with base and removable pre-punched top cap. Two types of end caps: one solid, one spouted per channel with anti-drip drainage design. Holes in top cap are pre-punched on 8” centers.
- **Nutrient Delivery Return System:** High efficiency circulation pump(s) and includes main poly feed line with feeder tubes, punch, valves, filter, hardware and 4’ opaque nutrient return system.
- **CropKing NFT Fertroller System:** Pre-wired microprocessor with pH and EC control. Nutrient injector system and acid injection pump (pre-assembled, mounted and tested). Three concentrate tanks and plumbing kit are also included.
- **Nutrient Tanks:** UV stabilized plastic underground tanks (may be deducted from package and purchased locally to save freight. (1000 Gal Tanks)
- **Nursery Seedling System:** Lettuce nursery for seedlings - 2 white PVC nurseries and seedling trays to be located in the front of each bay.
- **NFT Channel Supports:** Gatorshield galvanized steel frame for supporting the growing channels and connecting hardware.

Testing Equipment Myron AG-5 Conductivity DS Meter, TDS Conductivity Standard (1/2 pint) Fisher pH Test Kit, Sensaphone Model 1104, Sensaphone Remote Temperature Sensor, Nutrient Mixing Pump, Mini-Max Thermometer (2), pocket sling psychrometer, white ground cover for floor under beds. Vacuum Seeder is included with 2 Bays and larger to eliminate hand seeding.

Growing Supplies The hydroponic fertilizer is based on a recipe which uses the water at your greenhouse as the base. It is an estimated one year supply of fertilizer along with adequate 1 inch Rockwool cubes and seeds for the first three crop rotations. Getting the fertilizer with your greenhouse shipment can help to save on freight dollars and help with cash flow until you are selling your crop.

Additional Options

CO2 Enrichment and Control System Johnson CO2 generator, one per unit, electronic remote CO2 monitor with control package pre-wired and programmed into the iGrow 1400 environmental controller.

Shade Cloth 40% white exterior shade cloth including cable tie down kit and shade cloth quick clips. Note: 50% white shade cloth is available at additional cost for deep south applications.

Insect Exclusion System A “screen room” which extends the south end of the greenhouse by 8 ft. This additional 8’ of greenhouse is covered with NO-Thrip Insect Screening and covers the power vent door to stop insects from being pulled through the wet wall into the greenhouse. One of the best answers to insect control in the greenhouse is to stop them from ever getting in. This price includes an access door into this 8’extension for maintenance of the wet wall. Also included is an additional entrance door and air curtain to turn a customer supplied head house into an air-locked greenhouse entry reducing the chance of insects entering through the main entrance of greenhouse.

Steel Endwalls and Sidewalls: CropKing’s galvanized structural Steel endwall package includes 3 steel framed endwalls and 2 steel sidewall baseboards made of structural 1 1/2 in. x 3 in. galvanized C channel, aluminum brackets, hardware and additional end wall bracing and connecting hardware. Pricing on a per project.

High Efficiency Unit Heater Upgrade This option replaces one 80% efficient unit heater per bay with a 93% efficient separated combustion, high efficiency Modine PTC-180 Effinity93 Unit heater. Pricing based on location.

Remote Access Software Also available is a remote monitoring and programming software package which allows the iGrow to be attached to a host computer and allows for ease of programming.

Complete Package Pricing

	Freestanding 30' x 128' 6,192 grow out	Gutter Connect 44' x 128' 2 Bay 9,306 grow out	Gutter Connect 88' x 128' 4 Bay 18,612 grow out	Gutter Connect 176' x 128' 8 Bay 37,224 grow out
Structure and Covering	\$ 9,962	\$ 23,994	\$ 42,434	\$ 79,319
Cooling System, Vent Door, Air Circulation, Heaters, Environmental Controls, Electrical Panel and Technical Support	\$ 16,781	\$ 22,872	\$ 38,447	\$ 69,748
Growing System	\$ 22,034	\$ 32,608	\$ 62,334	\$ 120,356
Testing Equipment and Growing Supplies	\$ 7,388	\$ 9,899	\$ 17,563	\$ 32,470
Standard Package Total	\$ 56,165	\$ 89,373	\$ 160,778	\$ 301,893
Additional Options				
CO2 Enrichment and Control System	\$ 1,100	\$ 1,830	\$ 3,290	\$ 6,209
Shade Cloth	\$ 755	\$ 1,904	\$ 3,254	\$ 5,960
Insect Exclusion System	\$ 3,153	\$ 4,929	\$ 7,387	\$ 12,294



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