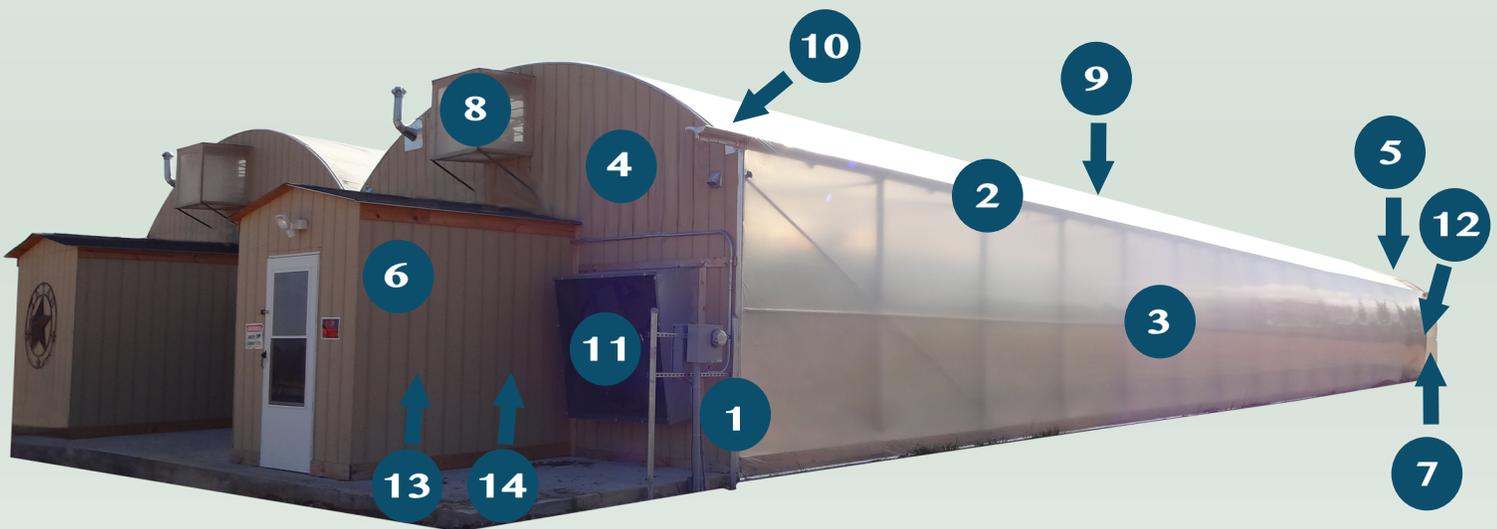




Gutter-Connect Greenhouse

CropKing specializes in the sale and technical assistance of hydroponic growing systems, and our gutter-connect greenhouses are an essential component of these hydroponic packages. Our frame design and equipment selection were chosen to optimize crop production from the NFT and Bato bucket systems. Commercial growers throughout the US and beyond have seen high yields and commercial success through the use of our hydroponic system packages.



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| 1 Gutter-connect frame | 8 Jet fan shutter |
| 2 Extruded aluminum gutters | 9 Vertical Air Flow Fan |
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1. The CropKing Gutter-Connected Greenhouse is a series of 22' wide bays connected to the next bay by an aluminum gutter and expandable by adding on more bays as your business grows. 16 Bays (352 ft wide) equals approximately one acre. The column posts, which support the gutter are spaced 8' on center. Our standard greenhouse is 128 feet long. This structure has a 90 mph wind load rating, and that wind load rating is increased to 130 mph when the cover is removed. The frame has a 20 lb snow load when the greenhouse is heated to a minimum of 50 degrees F. Arches are on 4' centers and there are three runs of purlins attached with cross-connectors and pipe straps along the length of the arches. The side and endwalls are connected with cross and wind bracing. The structure is made from Gatorshield galvanized (rust resistant) structural steel with a minimum of 50,000 psi yield and 55,000 psi tensile strength. The arches are 1.66" steel, and the bottom chords and purlins are 1.315" steel.

- 10 Foot High Gutter (necessary for taller vine crops)
 - 10' column post height, spaced every 8'
 - 2.5" wide square steel column posts
 - 1.66" diameter 14GA frame members
 - Members are attached using aluminum cross- connectors, pipe straps, and brace bands
- 8 Foot High Gutter (usually used for shorter leaf type crops)
 - 8' column post height, spaced every 8'
 - 1.90" diameter 13GA column post
 - 1.66" diameter 14GA frame members
 - Members are attached using aluminum cross- connectors, pipe straps, and brace bands

2. The Extruded Aluminum Gutters do not rust like a steel gutter and are bracketed to each column post and secure the spanning arches. The gutter is 8" wide, wide enough for a person to walk along the gutter during polycover installation. The extrusion contains a quicklock base so the quicklock cap can be locked in place to secure the polycover attachment. This polylock package makes the installation and replacement of the polycovers simple.





3. The Double Poly Cover greenhouse film serves many purposes, it prevents the entry of pests and disease, protects the crop from high wind and precipitation events, and retains heat in the form of long wave radiation during the winter months. The main body of the greenhouse is covered with two layers of 6mil greenhouse plastic. The top layer is UV film, and the inner cover is an IR greenhouse poly—an IR film can deliver year-round savings. In the winter, this plastic cover prevents infrared radiation from escaping, which prevents heat loss and in the summer it blocks infrared radiation and reduces the need for some ventilation. Air is pumped between the layers of poly with an inflation fan kit. This air space between the covers helps to add insulation as well as keeps the covers taut so that they not wear from flapping in the wind.



4. The North End Wall is typically framed using locally purchased, heat-treated 2"x4" or 2" x 6" lumber and then covered in the grower's choice of material, such as T-111 barn siding. There is little or no sunshine that reaches the crop from the North end of the greenhouse, so covering it with a solid material and insulating it makes sense and saves on heating costs. Optionally polycarbonate and steel end wall framing can be purchased from CropKing.



5. The South End Wall is framed using locally purchased heat-treated 2"x4" or 2" x 6" lumber and covered in twin-wall polycarbonate that is part of the greenhouse covering package. CropKing frames are also available with steel endwall framing. Often we find it is more economical for the grower to frame the endwalls in locally purchased, heat treated lumber because the lumber is usually significantly less than the cost of steel.



6. The Head House constructed from local building materials adds a double entrance to the greenhouse, or first defence against pests and cold air during the winter months. A head house is a great location to place the injection system, the electrical panel, and computer storage.

7. The Insect Exclusion System extends the greenhouse frame 8' past the south endwall and is framed in thrip screen material. Thrip screen, with a mesh of 50 (0.0117 inch opening) is fine enough to prevent the entry of thrips (1 mm long or less, 0.0394 inch), which are typically the smallest greenhouse pest, thereby also excluding any larger greenhouse pest from entering the greenhouse when the intake door opens up on the evaporative cooling (wet wall). The insect exclusion package also includes an entrance door allowing rear access to the vent door and wet wall, a second entrance door into the head house, and an air curtain to prevent pets from entering into the head house. This package also includes a screened box to cover the intake of the gable vent fan





8. Motorized Gable Fan and Shutter bring outside air into the top of the greenhouse for de-humidification and for cooling during the winter months. This fan is located above the entrance door in each bay and includes motorized shutters which open and closes as needed. This air which is pulled into the top of the greenhouse through the gable fan is used for humidity control and is part of the winter cooling in the greenhouse. During the winter months when the outside temperatures are much too cold for the plants,

the gable fan air into the top of the greenhouse that is picked up by the VAF fans (see below) and dispersed throughout the greenhouse. Even in the month of January when it is very, very cold outside; sunshine on the greenhouse can cause it to become too hot inside for the plants. It is not good to open up the large evaporative cooling doors in the back of the greenhouse and shock the plants with a blast of outside frigid air. Allowing small amounts of cold air into the top of the greenhouse through the gable fan and blending it in gently with the warm moist air in the greenhouse works well and does not shock the plants.



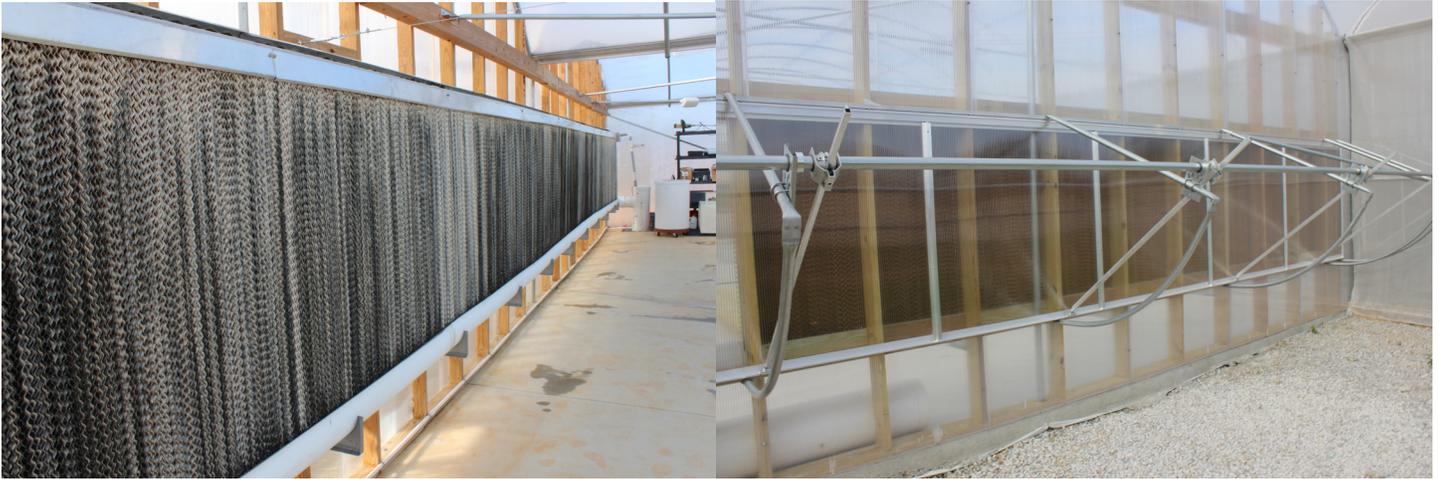
9. The VAF (Vertical Air Flow) system circulates air in a vertical vortex to prevent temperature and humidity stratification. With months of comparison research CropKing saw a great improvement with better air movement by using a vertical airflow fan rather than a convection tube to move the air from the heaters as well as the winter cooling down the full length of the greenhouse. We also saw a marked improvement in powdery mildew control with the VAF fans. Two of these VAF fans are located in each bay of the greenhouse.

10. The Overhead Unit Heaters are manufactured by Modine, a well know name in the greenhouse industry and one that CropKing feels is very dependable with less maintenance issues. These heaters were designed to work in the mosit humid air of a greenhouse and CropKing sizes them based on the coldest temperature in your area. These heaters have been sized for your location. The primary heater (the one that runs most of the time) is a 93% efficient heater. The backup heater, a less expensive 80% heater is designed to only come on if the primary heater can not handle the load.





11. The Exhaust fans are manufactured by American Coolair and are located on the North end wall. There are two American Coolair slant wall exhaust fans in each bay. Air is pulled from the South end of the greenhouse through an evaporative cooling system and exhausted out the through these fans in the North end of the greenhouse.



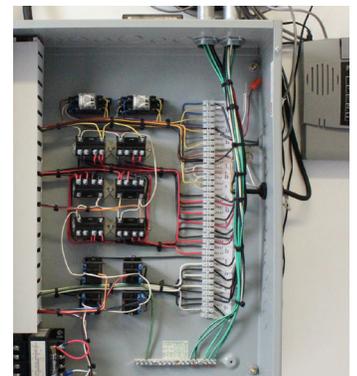
12. The Evaporative Cooling Wall and vent door are located in the South end of the greenhouse. When the exhaust fans turns on, it pulls outside air through the open vent door and is cooled as it is drawn across the wet pads and then exhausted out through the exhaust fans in the North end of the greenhouse. Power Vent door is pictured below. This automated wet wall door is operated by the iGrow Controller (the brains of the greenhouse) and is opened and closed as needed. The framework of the door is extruded aluminum to avoid rusting and the door is covered with 8mm polycarbonate. A heavy duty right angle gear motor with limit switches to adjust opening and closing positions.



13. The iGrow Control System is the computerized environmental control system. This is the

brains of the greenhouse. It allows precision control of the heating and cooling. It is the iGrow 1400 with 12 outputs. It includes temperature and humidity sensors, housed in special radiation housing. Also included is an outside air temperature sensor. This unit(s) is mounted and pre-wired to the electrical panel board.

14. The Electrical and Breaker Panel is a pre-wired electrical panel ready to install in the greenhouse. The electric panel is pre-mounted on a white painted board with the relay box and the iGrow controller. It is only necessary to provide



incoming power and then run the wires from the terminal strips out to the equipment in the equipment in the greenhouse. Our panels are NEMA enclosures because of the greenhouse environment. CropKing uses only UL listed components, however some codes require that the constructed panel be UL listed. In some areas agricultural buildings are exempt from electrical zoning. Please check with your local electric codes.