PERCIVAL

Thank You for the Opportunity to Present Here Today!

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Percival's Model PGC-10

CHAMBER GROWTH AREA = 1 m^2 or 10.5 ft^2

Percival's High Efficiency Lamp Bank, patent pending

Percival's High Efficiency Lamp Bank, patent pending

- Patent Pending Design- Filed January 9, 2007, U.S Serial No. 11/621,412
- Designed to optimize the performance of fluorescent bulbs by controlling the temperature inside the lamp bank
- Energy efficient T5 lamps can be used with no degradation of performance
- Barrier reduces amount of heat introduced into the controlled environment
  - Improved temperature uniformity (less gradient) inside the growing space
  - Improved performance of other systems
  - Plants may be grown closer to the light source
- Flexible design can be used for multiple bulb types
- Energy Efficiency
  - High efficiency bulbs produce the same quantities of light as alternatives, but consume less energy
  - Less bulb wattage (heat) has "cascade effect" on other systems

Lighting Efficiency Comparison

	PGC-10 MODEL	Redesigned PGC-10 MODEL
LAMP TYPE	F48T12/CW/VHO	F54T5/841/HO
LIGHT OUTPUT @ 6" FROM LAMPS	1000 µmoles/m²/sec	1075 µmoles/m²/sec
HEAT GENERATED BY LIGHTING SYSTEM	6664 BTU/hr	3644 BTU/hr
LIGHTING POWER CONSUMPTION (WATTS)	2312	1212
COST PER KWH	$0.117	$0.117
PHOTOPERIOD (HOURS/DAY)	16	16
ANNUAL LIGHTING OPERATING COST $	$1,580	$828
ANNUAL SAVINGS ON LIGHTING $		$752
ANNUAL SAVINGS ON LIGHTING (KWH)		6420

Air Circulation Fans

- External, shaded pole motor
- Enclosed motor runs, and remains clean for increased operating life
- Durable, die cast aluminium housing
- Maintenance free, stainless steel ball bearings for quiet operation
- Lightweight
- High efficiency fan blades circulate large amounts of air
- High temperature tolerance for extended temperature applications (up to 75°C).
- Power consumption per fan : 84W
- Power consumption per each old fan: 132W.
- **Annual electrical savings by switching two fans: $98 or 841KWH**.

Heating Cycle

- Utilize refrigerant hot gas for chamber heating
- The logic in the controller de-energizes electric heaters when any type of lamps are on
- The logic in the controller de-energizes electric heaters during the night cycle when temperature inside the chamber is below 24°C
- Annual electrical savings when operating the chamber at 24°C lights on for 16 hours and 18°C lights off for 8 hours: $239 or 2044KWH

Computer Controller vs. Standard Controller

- Touch screen controller vs standard vacuum fluorescent display controller
- Annual electrical savings when operating the chamber : $25 or 210 KWH

Air-cooled Refrigeration Systems Operational Savings Comparison

	PGC-10 MODEL	Redesigned PGC-10 MODEL
LAMP TYPE	F48T12/CW/VHO	F54T5/841/HO
LIGHT OUTPUT @ 6" FROM LAMPS	1000 µmoles/m^2/sec	1075 µmoles/m^2/sec
HEAT GENERATED BY LIGHTING SYSTEM	6664 BTU/hr or 1940W	3644 BTU/hr or 1072W
CONDENSING UNIT POWER CONSUMPTION (Watts)	2695	1726
COST PER KWH	$0.117	$0.117
ANNUAL REFRIGERATION ELECTRICAL OPERATING $	$2,762	$1,769
ANNUAL SAVINGS ON REFRIGERATION SYSTEM		$993

Water-cooled Refrigeration Operational Savings Comparison

	PGC-10 MODEL	*Redesigned* PGC-10 MODEL
LAMP TYPE	**F48T12/CW/VHO**	**F54T5/841/HO**
LIGHT OUTPUT @ 6" FROM LAMPS	**1000 µmoles/m²/sec**	**1075 µmoles/m²/sec**
HEAT GENERATED BY LIGHTING SYSTEM	**6664 BTU/hr or 1940W**	**3644 BTU/hr or 1072W**
CONDENSING UNIT POWER CONSUMPTION (Watts)	**2163**	**1580**
COST PER KWH	**$0.117**	**$0.117**
ANNUAL REFRIGERATION ELECTRICAL OPERATING $	**$2,217**	**$1,619**
ANNUAL SAVINGS ON REFRIGERATION SYSTEM		**$598**
DAILY WATER USAGE SAVINGS		**540 gallons or 2044 liters**
ANNUAL WATER USAGE SAVINGS		**197,100 gallons or 745,060 liters**

Total Annual Savings

	ANNUAL SAVINGS $	ANNUAL SAVINGS (KWH)
LIGHTING SAVINGS	$752	6420
AIR CIRCULATING FANS SAVINGS	$98	840
HEATING SYSTEM SAVINGS	$239	2050
STANDARD CONTROLLER SAVINGS	$25	210
REFRIGERATION OPERATIONAL SAVINGS	$993	8490
TOTAL ANNUAL SAVINGS	**$2,107**	**18,010**
WATER-COOLED CONDENSING UNITS ONLY		
ANNUAL WATER USAGE SAVINGS (LITERS)	**745,060**	
ANNUAL WATER USAGE SAVINGS (GALLONS)	**197,100**	

NOTE: AN OLYMPIC SIZE SWIMMING POOL HOLDS 2,500,000 liters or 660,253 gallons OF WATER

Stainless Steel Surface vs. Highly Reflective White Surface

- Stainless steel interior surfaces are attractive
- Percival Scientific offers this finish as standard in some non-lighted models and optional in all chambers
- Discourage using stainless steel interiors with medium to high light requirements
- **In order to obtain the same light intensity in a plant growth chamber with stainless steel interior at least 30% more lighting is required**

Phase Out Schedule for HCFCs Refrigerant R-22

- Percival Scientific does not use R-22 or HCFC refrigerant in any chambers.
- January 1, 2010: Chemical manufacturers may still produce R-22 to service existing equipment, but not for use in new equipment.
- January 1, 2020: Chemical manufacturers will no longer be able to produce R-22.
- Use of existing refrigerant, including refrigerant that has been recovered and recycled, will be allowed beyond 2020 to service existing equipment.
- **R-22 should continue to be available for all systems that require R-22 for servicing for the next 20 years or more.**

Fluorescent Lamp Recycling

- Under federal regulations, commercial and industrial entities are required to manage mercury-containing light bulbs as a hazardous waste after they burn out.
- Low-mercury light bulbs can be identified by “end caps” that are painted green.
- Linear T-5 fluorescent bulbs contain 3.5 to 4 milligrams of mercury (low)
- T12 VHO lamps contain from 8 to 14 milligrams of mercury.
- It is estimated that 670 million fluorescent light bulbs are discarded each year in USA. These discarded bulbs can release approximately 2 to 4 tons of mercury per year into the environment.
- Virtually all components of a fluorescent bulb can be recycled. The metal end caps, glass tubing, mercury and phosphor powder can be separated and reused.
- For information about these recycling programs visit www.earth911.org.

Challenge

If every home in the USA replaced just one incandescent light bulb with an energy star CFL, in one year it would save enough energy to light more than *3 million homes* and prevent greenhouse gas emissions equivalent to those of more than *800,000 cars*.