STERIL-AIRE®

Pure Air. Real Science.™

An Energy Saving, Indoor Air Quality,
&
Sustainability Initiative

For

NEWS LIMITED

UVC Study Report

AHU-3
@

The Cairns Post

PO Box 4226, Mudgeeraba 4213
Phone: 1300 781 128 Fax: 07 5559 2447 Email: steril-aire@sas-aust.com

STERIL-AIRE

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The Cairns Post
Cairns, QLD 4870

September 13, 2010

Study Introduction

Product Technology Overview

Steril-Aires world leading UVC technology provides multiple benefits with a short return on investment.

Energy Saving:

The biofilms that build up on the cooling and heating exchange plates (or fins) inhibit the heat transfer process and reduce the airflow.

Steril-Aire's Emitters™ destroy these biofilms restoring and maintaining coils as close to their `as original performance and efficiency'. Typical savings are 15-30%.

Maintenance Savings:

By destroying the biofilm and organic build up on the cooling coils Steril-Aires Emitters™ eliminate the need for manual cleaning and chemical usage. Coils, drain pans and plenums stay free of mould and bacteria.

Duct cleaning can also be reduced or eliminated (depending on the severity of contamination and filtration standards) as the cooling coils and drain pans are the food source for the mould that grows downstream in the duct work. The very high output UVC Emitters™ destroy the food source so the mould in the duct work starves and dies.

Other maintenance benefits include free flowing drain pans and drain lines (no slime/algae build up) and removal of odours caused by the mould growing in the ducts and also odours created within the building.

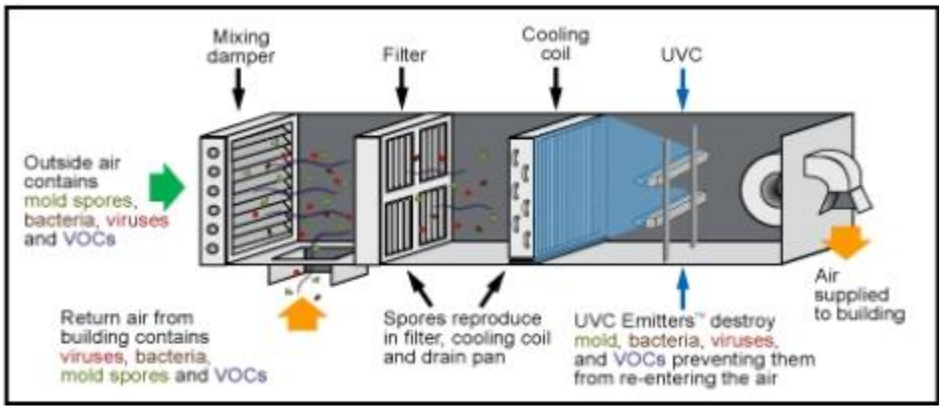
Health:

Steril-Aire's Emitters™ can eliminate up to 99.9% of airborne viruses and bacteria and other microbes, significantly improving indoor air quality (IAQ).

Hospitals in the USA have shown significant reduction in Hospital Acquired Infections (HAI's).

Provide staff and visitors protection against future pandemics. Steril-Aires high output UVC is very effective in destroying all airborne Flu and SARS viruses, MRSA, pneumonia, TB (incl new super strains recorded around Australasia), Legionnaires Disease and the common cold.

Reduced allergy and asthma symptoms triggered by biofilm and mould. Independent studies have shown reductions in staff absenteeism and improved productivity when using Steril-Aire UVC Emitters.



Sustainability:

This can be achieved in many ways with the use of Steril-Aires Emitters™:

- Destroys Bacteria in condensate water from the drain pans allowing it to be recycled. An example is make-up water in cooling towers, resulting in a reduction in water and chemical consumption.
- Reducing chemicals used within the building
- Reduce Ozone created within the building from photo copiers, furniture etc
- Extending the life of the air conditioning equipment by restoring and keeping components and interior surfaces clean and free of mould and organics containing moisture causing corrosion and degredation.

A simple effective way of reducing carbon footprint with so many other benefits.

Study Objectives

To show Steril-Aires UVC technology reduce energy and maintenance costs whilst improving Indoor Air Quality, Therefore becoming part of News Ltd's **1 Degree** initiative :

- Visual difference in cleanliness of cooling coils and drain pans in approximately 30 days
- Efficiency improvement from better coil heat transfer resulting in a 10-20% energy reduction
- Improved Indoor Air Quality
- Reduction in mould growth within system
- Produce clean condensate water suitable for recycling
- Return on Investment in under 2-Years

Tests to be conducted before and after UVC installation:

- Wet and Dry Bulb temperatures before and after cooling coil
- Cooling coil pressure drop
- Airflow/velocity readings
- Coil and drain pan surface contact plates
- Photos (Pre and Post UVC)

Using the above data, AHU manufacturers design performance and basic HVAC guidelines from ASHRAE/AIRAH we can calculate efficiency improvements.

Study Results @ 36 Days

AHU - 3

Manufacturer: York GS1K
Total Design Airflow 2800 litres/sec (5900 CFM)

Pre Testing Date: 27/07/10
Post Testing Date: 01/09/10

Testing for AHU-3 included:

- AHU entering and leaving Temperature (wet and dry bulb) used for the Life Cycle Estimate. Temperature and Humidity recorded using data loggers.
- Airflow at the main return air grille using a digital vane anemometer. Multiple readings taken as a mean average over 30 seconds at each point (filters removed).
- Pressure drop across the cooling coil using a dual port manometer (filters removed).
- Rodac contact plates used for checking before and after microbial counts on cooling coils and drain pans.

Each testing period is carried out with the system at 100% load.

Cooling Coil Pressure drop **(Filters removed):**

27/07/10	1/09/10
101 Pa (pascal)	71 Pa (pascal)
Coil Pressure Drop Reduction 29 %	

The reduction in static pressure shows that the UVC is destroying the build-up of biofilm on the Cooling fins. Less restriction means more airflow and better heat transfer.

Airflow:

AHU-3 Main Return Air Grille Total combined readings in Cubic Feet Per Minute (CFM)	27/07/10	1/09/10
Total Average	364.6	426.5
Airflow Velocity Improvement	**17%**	

Notes:

Airflow readings are taken in CFM (Cubic Feet Per Minute) and were recorded as a mean average over 30 seconds per point to show an average improvement.

Chilled Water Coil – Entering/Leaving Delta T

27/07/10		1/09/10	
CHW Entering Temp	7.2 deg C	**CHW Entering Temp**	8.2 deg C
CHW Leaving Temp	10.2 deg C	**CHW Leaving Temp**	12.4 deg C
CHW Delta T	3.0 deg C	**CHW Delta T**	4.2 deg C
Efficiency Improvement:	**40%**		

An increase in the chilled water entering and leaving temperature difference (Delta T) is a clear indication that the coil is operating more efficiently. The chilled water pumped through the coil is absorbing more heat from the air as it passes through the clean cooling fins.

Coils and drain pan in AHU-3 before and after bathed in very high output 253.7 nanometer Germicidal UVC Light

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Life Cycle Estimate:

The Life Cycle Estimate program provides a way of showing savings that can be achieved by using Steril-Aires Emitters™. The attached document entitled `Enthalpy' explains in detail how the program works.

In summary, the data retrieved during testing and associated costs with installing the Emitters™ is entered in to the program. The program then provides indications of the achievable savings over a 4-Year period.

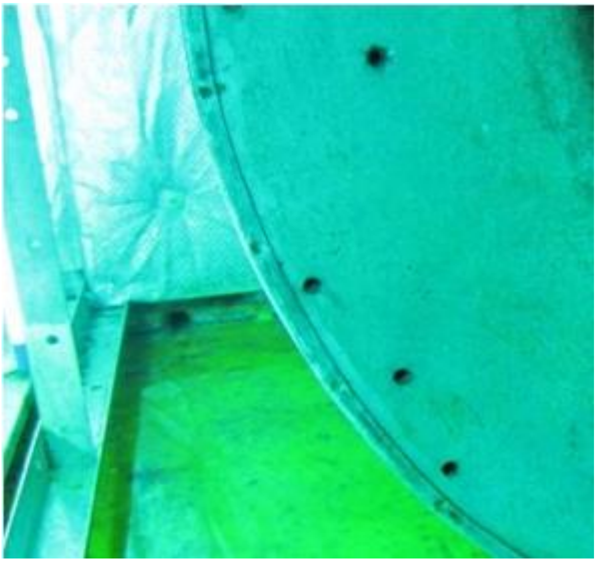
Please see attached Life Cycle Cost – Estimate Sheet for details

Summary of improvements @ 36 Days: AHU-3

Cooling Capacity gain:	**18kW**
Airflow increase:	**17%**
Coil Pressure Drop Reduction:	**29%**
Cooling Coil Efficiency Improvement:	**40%**
Return on Investment:	**7½ Months**

Note: UVC Emitters will continue to make improvements to the efficiency of the system

27/07/10



1/09/10 – 36 days post UVC
No Algae in condensate water
No Mould spores on fan housing
Improvements in plenum wall insulation

Plenum wall insulation is being cleaned by the UVC, extending equipment life

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Carbon Emission Reduction:

Based on the data we have retrieved and the greenhouse gas emission factors for Queensland electricity according to NGA Factors (2010) are: **1123.6 kWh per tonne of CO2-e (Scope 2)**

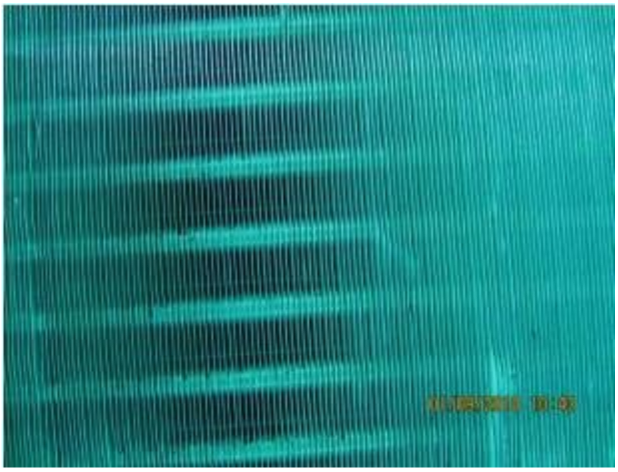
Based on a cost $0.142 per kWh of electricity

AHU-3

1st Year kWh improvement after installation and operating cost deductions is 15,436kWh or 13.7 Tonnes of Co2 emissions

Therefore AHU-3 on 2nd year and each year after including operating cost deductions:

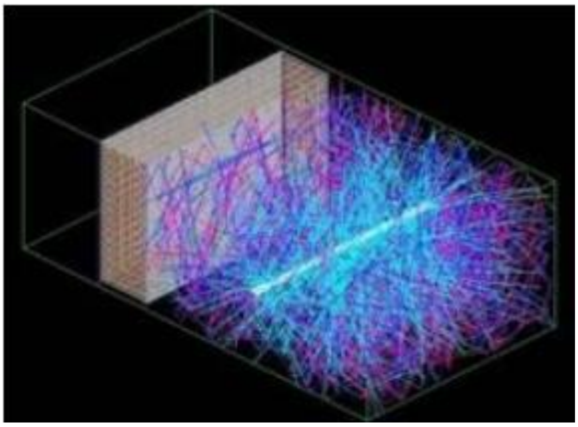
Equivalent of 33,845 kWh or a Reduction of 30.1 Tonnes of Co2-e per annum

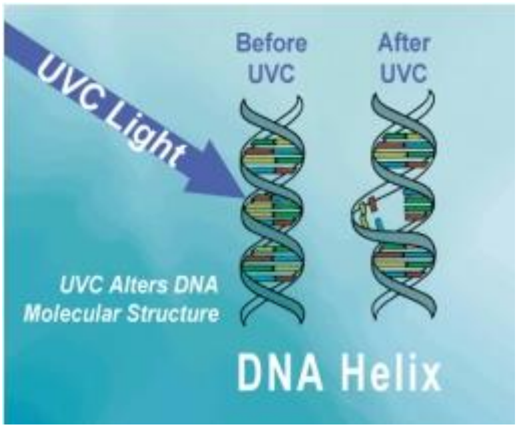



Cooling Coil and Plenum walls during the UVC cleaning process

Acknowledgements:

Andrew Kilgallon
Cogent Partners (Gordon Gudgeon)





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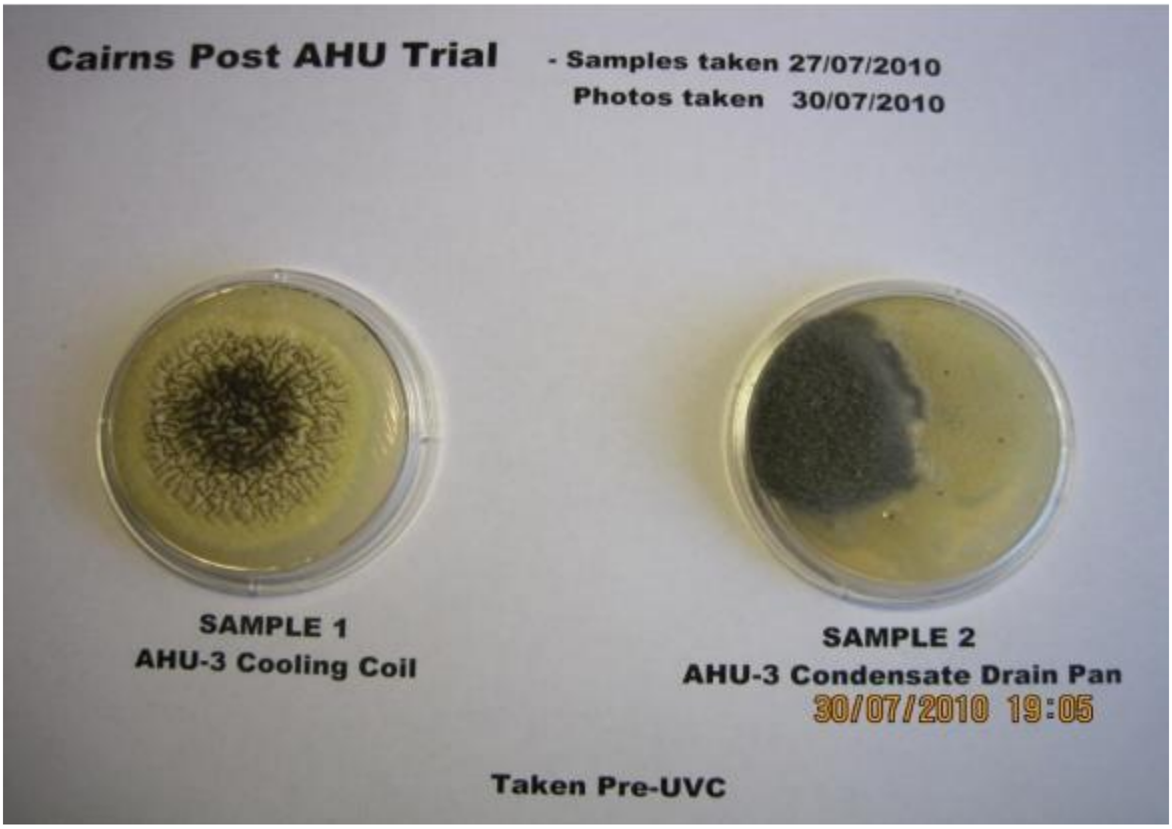
Microbial Testing

Method: Surface sampling of Cooling Coils, Condensate Drain Trays using Rodac Contact Plates to indicate fungal and bacteria CFU's.

Plates: Certified Sabouraud Dextrose Agar, enough to form a positive meniscus.




Cairns Post AHU Trial
- Samples taken 01/09/2010
Photos taken 04/09/2010
05/09/2010 11:15
SAMPLE 1
AHU-3 Cooling Coil
SAMPLE 2
AHU-3 Condensate Drain Pan


SAMPLE 3
04/09/2010 12:09
AHU-3 Plenum Wall

STERIL-AIRE™, Inc. ©

LIFE CYCLE COST - ESTIMATE SHEET

Fill In All Yellow Blocks | **Answers Are In Green and Gray**

Project Name:	News Ltd	**Date:**	14-Sep-10
Location:	Cairns Post	**Contact:**	Andrew Kilgallon
	Cairns Post	**Engineer:**	MC
AHU Tagging:	AHU-3	**Contractor:**	Cogent Air

UVC Installation	Before		After	
Date Sampled:	27-Jul-10		1-Sep-10	
CFM - Measured or Selected (VAV)	4,870		5,700	
Entering Air Temperature - Dry Bulb °F	71.0		72.4	
Entering Air Temperature - Wet Bulb °F	62.6		62.4	
Leaving Air Temperature - Dry Bulb °F	56.3		54.1	
Leaving Air Temperature - Wet Bulb °F	54.0		51.9	
Total Cooling Capacity - Btuh	114,615		179,294	
Sensible Heat -Btuh	77,316		112,716	
Latent Heat - Btuh	37,299		66,577	
Net Cooling Capacity Gain - Btuh	→	64,678		
Pressure Drop "Across Coil"	0.41	" WG	0.29	" WG
Pressure Drop Reduction	0.12	" WG		
Pressure Drop BHP Reduction	0.179		6.0	
		EER:		
Annual Operating Hours	2,964		Before	
Energy Cost per kWh	$0.14	EER:	8.2	
Annual Improvement (kWh cost)	$4,638		After	
Annual Coil Cleaner & Biocide Cost	$200			
Annual Coil Cleaning Labor Cost	$800			
Annual Drain Pan Cleaner & biocide Cost	$120			
Annual Drain Pan Labor Cost	$240			
Annual Maintenance Costs	$1,460			
Total Annual Improvement	$6,098			

Installation Costs	1st Year	2nd Year	3rd Year	4th Year
Number of Fixtures	4			
Average Fixture Cost Each	721.00			
Installation Labor Cost	650.00			
Fixture(s) Annual Energy Cost (8760 hrs)	371.93	371.93	371.93	371.93
Emitter Replacement Cost (each)		85.00	85.00	85.00
Annual Emitter Replacement Cost		340.00	340.00	340.00
Total Installed & Operating Cost	$3,905.93	$711.93	$711.93	$711.93
Annual Improvement (Less Costs)	$2,192	$5,386	$5,386	$5,386
Estimated Return (years)	0.641			
Cumulative Improvement	$2,192	$7,579	$12,965	$18,351

For additional assistance please contact your local Steril-Aire representative or Steril-Aire direct at (562)467-8484.

Enthalpy

Steril-Aire has obtained an application patent for the placement of its high output UVC Emitters around the coil area. One of the reasons for this location is that of returning the coil to its original heat exchange efficiency. The process includes the degradation of mold, bacteria and other residual organic material… essentially cleaning the coil. This process has proven to be much more effective than the classical methods of coil cleaning, which leave much of the material behind, can damage the coil, and are a short term only solution. On the other hand, Steril-Aire Emitters provide a complete and continuous cleaning without dangerous chemicals.

Coils can lose as much as 30% of their capacity in as little as one year. This loss is referred to as the “total heat” loss. Determining the loss is dependent on system operating characteristics. The purpose of this chapter is to explain some of the elementary concepts of total heat, as a quick reference, for those who don’t work with them regularly. It also provides the background as was used in the construction of the Steril-Aire Life Cycle Cost diskette. This should give one the confidence of utilizing UVC Emitters on the merits of coil cleaning alone. Yes, UVC can be as much a maintenance tool as a microbe killer and as such, has paid for itself in as little as four months! What is discussed are the properties of coil pressure drop, its air temperatures (wet and dry bulb) both entering and leaving the coil, and system airflow.

Coil Pressure Drop – inches of water gauge
That a coil has a pressure drop associated with it indicates that air requires energy to get through it. The percent increase is the result of a decrease in open area. An increase in coil pressure drop is therefore an indication that a cooling coil is losing heat transfer capability. Assuming similar system characteristics, coil pressure drop can only increase when the coils open area decreases. Decreased open area results from an increase in coil fin thickness and this increase is associated with the build up of material on the coil. Two things happen as a result, (i) system air volume is decreased and (ii) the time required for a given amount of heat to transfer increases and so it is this decreased amount of heat times a lower volume of air that results in less heat transferred. The “air leaving temperature” rises several degrees from when new (clean), while at the same air entering temperature. This temperature is referred to as “dry bulb” or sensible heat temperature.

Properties of Air – Psychrometric Chart
The properties of air are best understood by observing a psychrometric chart and visualizing a container filled with “one pound of air”. For the following examples, this one pound of air will be at typical comfort conditions of 70°F and 50% relative humidity. Knowing these two properties allows one to determine all other air properties by using a psychrometric chart.

Dry bulb temperature - degrees Fahrenheit
In the example above, the temperature is 70 degrees, which is commonly referred to as dry bulb temperature or what is read from a standard thermometer. This is also called the "sensible" temperature of air or the heat that can be sensed by a dry thermometer. As described later, a wet thermometer measures the “wet-bulb” temperature. On the psychrometric chart, the dry bulb temperature of air is displayed at the bottom, increasing numerically from left to right.

Relative humidity - percent of saturation
The example air is at 50% relative humidity which means its half of what the air could hold if it were saturated (i.e. 100% RH or maximum). Heating the container of 50% RH air to 95°F

would reduce its relative humidity to 20%. Cooling the container air to 49□F would raise the relative humidity to 100%. If it were 70□F, we would back at the example of 50% RH.

This can be demonstrated on the psychrometric chart. Relative humidity is the series of curves originating from the left of the chart (100% relative humidity or “saturation curve") curving up to the right boundary. If one goes to the bottom of the chart and finds the vertical 95□F line then follows this line up vertically to the 20% saturation curve (relative humidity), this is the intersect of 95□F and 20% RH. If we go horizontally left to the saturation curve (100% RH) we note that when we go straight down we are at 49□F! If we go horizontally right to the vertical 70 □F line we are almost at the 50% RH curve. In this example, the amount of water in the air was always the same, only the temperature varied. In other words, the same amount of water in the air was “relative” to the airs’ temperature and thus the term relative humidity.

Important: Relative humidity relates more to the comfort zone than temperature; therefore, a coil must often control (remove) air moisture as a part of its overall cooling function (wet coil and drain pan). When this capability is compromised (dirty coil), the air could be 70□F but the RH may be at 70%. This would be an uncomfortable (but not uncommon) set of conditions.

Specific Humidity - pounds of moisture per pound of air
To define the specific amount of moisture (water) in the air, one can use its weight compared to the weight of the air. In the example of 70□F and 50% RH, its specific humidity is 0.0078 Lbs. of water per the one pound of air, or 0.0078 Lbs. of its total weight is water vapor (moisture). Some charts will give this in grains. As 7000 grains equal one pound then 0.0078 x 7000 = 55 grains of moisture, therefore, 6945 grains of the total weight is the weight of the air.

On the psychrometric chart, locate the 70□F and 50% RH intersect point and trace a horizontal line to the charts right edge. The scale here indicates the weight of the moisture (or water) in Pounds Moisture per Pound of Dry Air or the specific amount of moisture in the air sample. Go back to the Relative Humidity paragraph above and retrace the 95, 70 and 49□F examples and note they are always on the same “Pounds of Moisture per Pound of Dry Air” line.

Dew point temperature - degrees Fahrenheit
Wet coils and drain pans can be associated with the psychrometric charts saturation line. If moist air is cooled enough, it cannot hold the same amount of moisture and the moisture will condense. The temperature at which water condenses depends on the amount of moisture in the air, and is called the *dew point temperature*. The higher the amount of moisture in the air, the higher the dew points temperature.

The examples air moisture content is 55 grains and some of this moisture must condense if the air temperature were dropped below 49□F (100% RH). For instance, if a beverage were taken from a refrigerator and placed in the air sample, the beverage container surface will cool the surrounding air from 70□F to less than 49□F and moisture in the air next to the container will condense. Air cannot be over 100% relative humidity, therefore, dehumidification occurs when we remove moisture from the air by cooling it below its dew point temperature.

Wet-bulb temperature - degrees Fahrenheit

Wet-bulb temperature is taken by surrounding a thermometer with a wet wick and measuring the temperature as the wick water evaporates. As it evaporates, it draws heat from the thermometer bulb, cooling it in "proportion to the amount of evaporation". In the example of 70°F and 50% RH, the wet bulb thermometer would be cooled from 70°F to "58.5°F" by the evaporation, so the "wet bulb temperature" is 58.5°F. If the RH were higher, the thermometer would not be cooled as much. If the air were drier, the wet bulb temperature would be lower than 58.5°F.

On the psychrometric chart, the wet bulb lines start at the saturation curve and slant down to the right. At the saturation curve, the wet bulb and dry temperatures are the same. The wet bulb temperature is most useful, as it the way to determine "total heat". We will do this later.

Enthalpy – Btu' s per pound of air

Enthalpy is the measure of the total energy in the air. When air is hot and/or moist, its enthalpy is high. This is because we must add heat to evaporate moisture into the air and remove heat to condense it. Every pound of water requires some 1061 Btu's to evaporate it (or remove it), so the more moisture in the air the more heat the air contains and the more we have to remove to make our sensible temperature. Enthalpy then is a function of its sensible temperature (dry bulb) and the absolute amount of moisture it contains (wet bulb). Air pressure also plays a role.

For A/C work, enthalpy is defined as the "sum" of the sensible and latent heat in the air or "total heat". The term "latent heat" is another way of expressing the amount of "moisture" in the air but that heat is latent or it cannot be "sensed" by a dry bulb thermometer. On the psychrometric chart, the lines of constant enthalpy are located to the left of the saturation curve and slant down from left to right nearly parallel to the wet bulb lines. In the example the enthalpy at 70°F and 50% RH is 25.4 Btu's per pound of air. If we deduct the sensible heat Btu's from enthalpy, we are left with the latent heat Btu's.

Total Heat – System cooling capacity

Expressing enthalpy in Btu's allows us to quickly calculate the energy difference or total heat of one condition to any other condition. This is extremely useful for determining coil capacity gain or loss, but especially gain when using UVC Emitters to clean the coil. For example, if we normalize barometric pressure at 29.92 inches of mercury (air pressure) and assume we are always within A/C temperature conditions, we can use the wet bulb temperature to calculate system capacity. By measuring the air entering and leaving wet bulb temperatures, we can calculate the heat in and the heat out with the difference being the total heat removed.

As noted previously, air at 70°F and 50% would yield a wet bulb temperature reading of 58.5°F, this wet bulb reading would also contain 25.4 Btu's. So if this were the coils air leaving wet bulb temperature and the air entering wet bulb temperature was 68°F, at 68°F it would contain 32.4 Btu's. Therefore, the difference between air entering and leaving heat is 32.4 – 25.4 Btu's or "7 Btu's per pound of dry air". To relate this to system capacity, we need to know the system airflow and we're almost there.

Calculations – Simplified

At sea level or 29.92 inches of mercury, air weighs 0.075 pounds per cubic foot. Therefore, in one hour (Btu's per hour), one CFM would correspond to 4.5 pounds (60 min. x 0.075 = 4.5) or 4.5 pounds of air per hour equals 1 CFM. Total heat in Btu's per hour then becomes CFM x 4.5

x the difference between the air entering wet bulb (Btu content) and air leaving wet bulb (Btu content) or:

$$\text{Btu/hr.} = \text{CFM} \times 4.5 \times (h_1 - h_2)$$

Where: h_1 = total heat (Btu's) of air entering wet bulb temperature
h_2 = total heat (Btu's) of air leaving wet bulb temperature

The example under Total Heat, second paragraph, resulted in a difference of 7 Btu's per pound of dry air. If the systems airflow were 10,000 CFM, it would be as follows:

Btu/hr. = 10,000 x 4.5 x 7 or 315,000 Btu's per hour

If this system lost 30% of its capacity, the 7 Btu's per pound would be reduced to 5 Btu's per pound or 225,000 Btu's per hour. Now one can see what a 30% loss will do! Also, 12,000 Btu's per hour equals 1 ton of refrigeration, so 315,000 ÷ 12,000 = 26.25 tons of operating capacity, 225,000 Btu's per hour would equal 18.75 tons! Under these different conditions, the same unit will yield a capacity in tons different than the systems rating, which is usually conservative. However, the rating can be determined using an industry standard of: 400 CFM equals 1 Ton or in our case, 10,000 ÷ 400 = 25 tons.

Steril-Aire Life Cycle Costing Program

With the experience gained from above, one can use the Steril-Aire Life Cycle Costing program. It does the calculations and more. The following system data is needed "before" installing UVC Emitters and "after". The after is the new system data – after the UVC Emitters clean the coil.

1. CFM
2. Cooling coil air pressure drop
3. Air entering and leaving wet bulb
4. System operating hours
5. The cost per kWh
6. Current maintenance costs

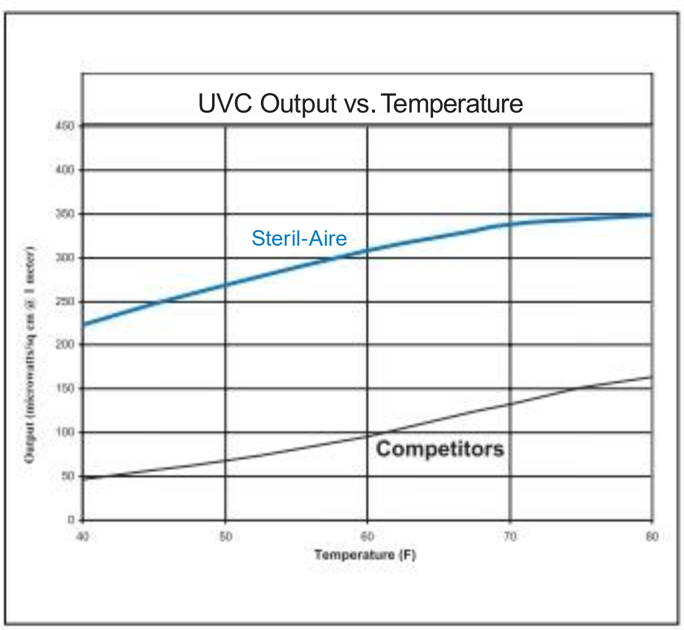
While entering this data, the program calculates the before and after costs associated with brake horsepower, capacity and maintenance. For capacity, the program uses a Lookup table (hidden in sheet 2) that contains the Btu content of wet bulb temperatures from 30 to 85°F. The table is from Chapter 3 of the 1961 ASHRAE Guide and Data Book. The program also includes other items such as fixture cost, labor to install, fixture energy consumption (operating 24 hours per day all year) and tube replacement cost. The results are expressed in payback and future savings through four years. One can get an educated look of what to expect if the original submittal data is available and if it indicates the design air entering and leaving wet bulb conditions. Simply collect the current data shown above and then input the design data in the after column, the program will do the rest.

Steril-Aire hopes that the foregoing has been informative and that it helps you to utilize the Steril-Aire life Cycle Costing program to demonstrate the near amazing ability of Steril-Aire UVC Emitters to return A/C system coil performance to as new specifications. Combining this feature with the products' ability to kill surface mold and bacteria, fly-by infectious disease organisms and the reduction of VOC's and other odors, makes the product a "must have" for any and all HVAC systems already installed or on the designers board.

UVC for HVAC™

Model SE Series UVC Emitters™

Single-Ended, Very High Output Germicidal Light Source for HVAC Systems



Steril-Aire's multi-patented UVC Emitter™ provides the best and longest-lasting UVC performance available. As shown in the comparison graph *(above)*, it has been independently tested to deliver an average of 5 times the output of other ultraviolet devices under HVAC operating conditions (45^{o} F @ 550 fpm air velocity).

Competitive UVC lights must be changed every 3-4 months because they quickly lose the output or "killing power" needed to maintain microbial control. The UVC Emitter, by contrast, has a 12-month service life – and even after a full year, it has 2-1/2 times greater output than competitive devices deliver on Day 1! As a result, only Steril-Aire can ensure the germicidal performance you need, with no return of microbial growth, for 3-4 times longer than the competition.

Applications

Steril-Aire Single-Ended (SE Series) fixtures install from the exterior of HVAC equipment, making them ideal for germicidal sites that are difficult to access. They are easily installed by making a one-inch hole in the equipment wall and/or duct, and then simply mounting the fixture to the unit exterior. Only the lamp or tube penetrates into the system, while the power supply remains external. Choose from six tube lengths (16", 20", 24", 30", 36" and 42") and four voltage options (115, 208, 230 or 277 Vac) to fit most applications, including:

- Fan coils, heat pumps, unit ventilators, terminal units and ductwork.

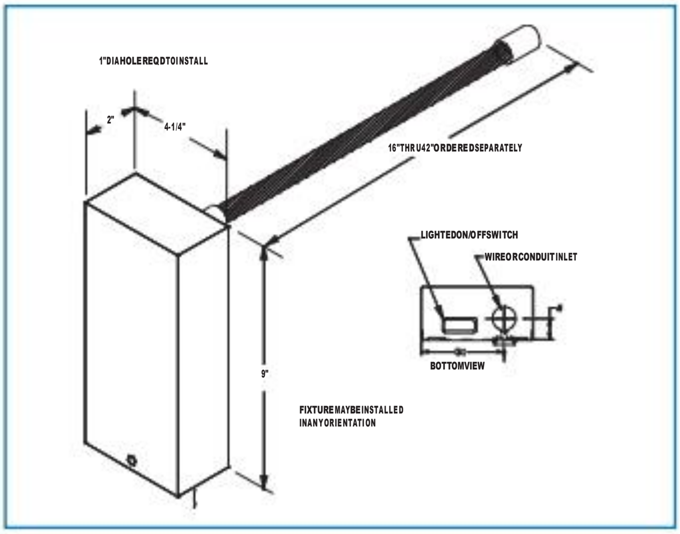
Benefits

- Kills or inactivates surface and airborne microorganisms that contribute to poor IAQ and/or the spread of infectious disease, including: mold and mold spores, bacteria *(including TB, Legionella, E. coli, Listeria, salmonella and whooping cough);* and viruses *(including colds, flu, measles).*
- Delivers an average of 5 times the output of competitive UVC products at HVAC operating temperatures, for 3-4 times longer life and more reliable germicidal control.
- Uses patented state-of-the-art solid-state electronic power supply for enhanced reliability and performance.
- Continuously cleans coils, drain pans, plenums and ducts, eliminating costly cleaning programs and the use of harmful chemicals and disinfectants.
- Lowers HVAC energy costs by restoring heat transfer and net cooling capacity.
- Produces no ozone or other secondary contaminants – will not harm building occupants, equipment or furnishings.
- Offers lowest life-cycle cost of any UVC product. Return on investment is often less than one year.
- Installs quickly and easily, with no need to open equipment – ideal for small systems and/or ducts.

Model SE Specifications

The UVC Emitter™ and fixture shall be factory assembled and tested. They shall consist of a housing, power source, Emitter socket and Emitter.

The housing shall be constructed of 304 stainless steel to withstand HVAC environments and shall be equipped with a 1/2" electrical conduit opening to facilitate wiring. All components shall be incorporated into one integral assembly that maximizes serviceability. It shall be designed for mounting from outside the airstream with only the Emitter in the conditioned air. Emitter shall be held in place and supported in the airstream by a patented integral collar, o-ring and heavy-duty spring wire fastener. The housing shall include an on-off switch and an indicator light to verify unit function.



This product may be covered by one or more of the following patents, others pending: 5,334,347/ 5,866,076/ 5,817,276/ 6,372,186/ 6,313,470/ 6,245,293/ 6,267,924/ 6,280,686/ 6,423,882.

The power supply shall be a Class P2, electronic rapid start type with a power factor of >0.95 and a power conversion of >75%. It shall be available in 115-208/230 or 277 Vac, 50/60 Hertz, and single phase. It shall be designed to maximize photon production, irradiance and reliability in cold or moving airstreams of 35-170° F, 100% RH and up to 2000 fpm. The design shall include RF and EMI suppression.

The socket shall be a Circline® 4 pin type with sufficient wire length to facilitate service.

The Emitter shall be a very high output, hot cathode, T5 diameter, Circline® cell-base type that produces a UVC band of 250-260 nm. Each tube shall be capable of producing the specified output at up to 2000 fpm velocity and temperatures of 35-170° F. It shall produce no ozone or other secondary contaminants.

Independent testing: The unit shall be tested by an independent test laboratory in accordance with the general provisions of IES Lighting Handbook, 1981 Applications Volume, and shall be verified through independent testing to provide output per 1" arc length of not less than 10 µW/cm2 at 1 meter in a 400 fpm airstream of 45° F.

Unit shall comply with UL Standard 1995 for use in HVAC equipment and shall carry the "UL" and "ULC" labels.

Ordering Information

Model No.	Part No.	Description	Length	Electrical	Weight
SE 1 VO	11001900	Single-Ended Fixture	N/A	115, 208, 230V: 70-85 watts	3.0 lb.
SE 1 VO	11002100	Single-Ended Fixture	N/A	277V: 70-85 watts	3.0 lb.
GTS 16 VO	21000100	UVC Emitter	16"	N/A	0.15 lb.
GTS 20 VO	21000200	UVC Emitter	20"	N/A	0.15 lb.
GTS 24 VO	21000300	UVC Emitter	24"	N/A	0.20 lb.
GTS 30 VO	21000400	UVC Emitter	30"	N/A	0.20 lb.
GTS 36 VO	21000500	UVC Emitter	36"	N/A	0.25 lb.
GTS 42 VO	21000600	UVC Emitter	42"	N/A	0.25 lb.

STERIL-AIRE®

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Represented By:

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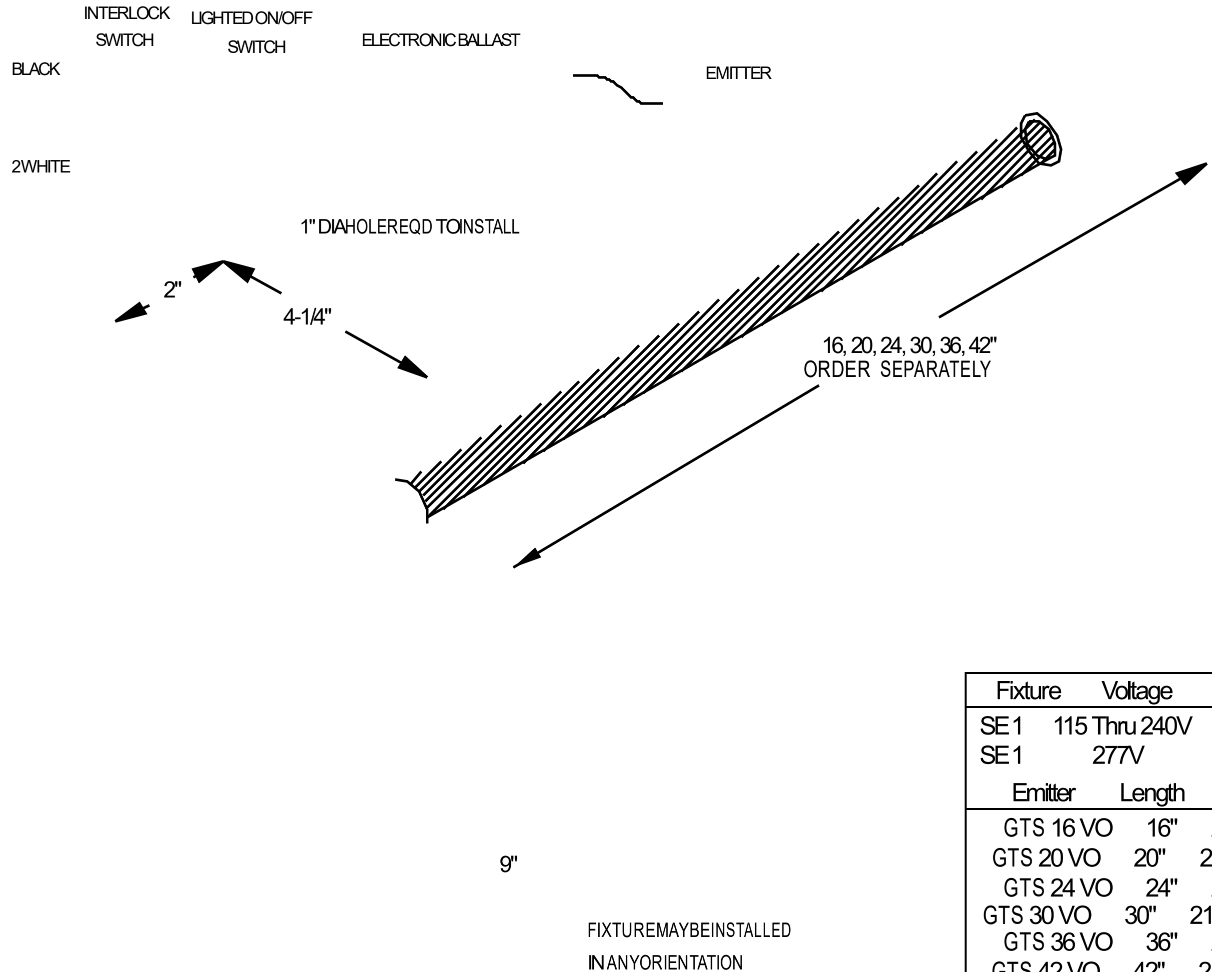

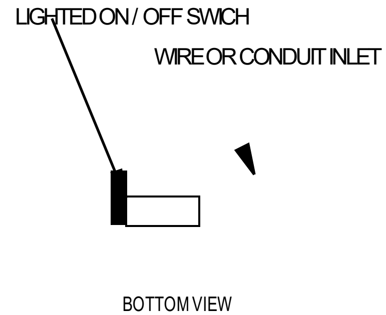

Fixture	Voltage	P/N	Wt	Amp Draw			
SE 1	115 Thru 240V	11001900	3.0				
SE 1	277V	11002100	3.0				
Emitter	Length	P/N	Wt	120V	208V	230V	277V
GTS 16 VO	16"	21000100	0.15	0.44	0.25	0.23	0.19
GTS 20 VO	20"	21000200	0.15	0.53	0.31	0.28	0.23
GTS 24 VO	24"	21000300	0.20	0.60	0.35	0.31	0.26
GTS 30 VO	30"	21000400	0.20	0.72	0.42	0.38	0.31
GTS 36 VO	36"	21000500	0.25	0.84	0.49	0.44	0.36
GTS 42 VO	42"	21000600	0.25	0.95	0.55	0.50	0.41

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