CLIMATE CONTROL SYSTEMS

CLEAN AIR BY EBERSPÄCHER
HOW TO GAIN THE PASSENGER’S CONFIDENCE?
GLOBAL CONCERN TO GET PEOPLE SAFELY BACK ON BUSES
Passengers be safe AND feel safe

- A UITP survey shows that when the pandemic first hit India early 2020: 90% reduction in ridership and 81% of operators had no ridership at all
- Ridership reduction is still down
- Get passenger confidence with awareness of solutions and benefits of an air conditioned bus
- Add simple label: promote ‘safe-bus’
- Global solutions must offer low life cycle costs to allow bus operators to remain competitive
- Global solutions must be able to meet local climate conditions
- Global solutions should be adaptable to all kinds of bus and AC system
WHAT DOES THE AIR CONDITIONING DO?
WHAT THE AIR CONDITIONING SYSTEM DOES AND DOES NOT DO WITH REGARD TO THE SPREAD OF COVID

• The virus is shed by people coughing and sneezing

• Larger droplets fall onto surfaces inside the bus

• Smaller atomised particles remain in the air and are either transmitted to other passengers or are carried by the air movement up into the AC unit

• It would be more effective to utilise fresh air, but this very inefficient, specially in tropical climate zones

• The AC system creates the air movement inside the bus; therefore our solutions concentrate on treating 100% of the air movement within the AC unit

• A well maintained AC unit can help reduce the virus concentration in the bus and actually make bus environment a safer place to be

https://www.pnas.org/content/117/26/14857
WHAT IS OUR APPROACH?
INTRODUCTION TO CLEAN AIR BY EBERSPÄCHER

Treatment of 100% of the air moving through the AC unit without generating ozone

- Our 3 step approach:
  - Level 1 = air filtration
  - Level 2 = air cleaning
  - Level 3 = air sterilisation

- Filtration = particle filtration
  => virus capture

- Cleaning = Polarised media electronic air cleaner
  => virus capture

- Sterilisation = UV-C LED Module
  => virus de-activation
CLEAN AIR BY EBERSPÄCHER
LEVEL 1
PARTICULATE FILTRATION
PARTICULATE FILTERS
High Efficiency Particle Air Filtration

- Used inside the AC unit and replaces the foam filters next to the heat exchangers
- Filter both fresh and recirculation air
- Different filter grades available, depending on local climate zones
  + Lowest initial cost
  + Mechanical installation only, no electrical interface (or power consumption)
- Short service intervals in dusty conditions (i.e. weeks)
- Not applicable to all global climate zones
CLEAN AIR BY EBERSPÄCHER LEVEL 2

POLARISED MEDIA ELECTRONIC AIR CLEANER
EAC (ELECTRONIC AIR CLEANER)
How does polarisation work?

- Polarised media electronic Air Cleaners combine both passive filters and electro-static precipitators.
  - A high voltage is applied to the centre screen of the media pad.
  - This creates an electrostatic field between itself and grounded external screen/frame.
  - This field polarises the fibres of the media pad and the particles that enter the air cleaner.
  - The polarised particles stick to both the media pad and each other in a process called agglomeration.
  - This results in 360° loading which means that every fibre of the filter can catch more dirt particles
  - This type of air cleaner can collect far more dirt particles before it becomes ‘blocked’
EAC (ELECTRONIC AIR CLEANER)
9+ years experience & proven effectiveness

- Replaces the normal return air grille
- Cleans recirculation air only
- Different sizes available to suit most applications
- Operates on less than 1.5 Watts of 24VDC
- Performance: removes 97% of the particles 0.3µm or larger

- Proven effectiveness to remove more than 90% of particles 0.3 micron in 1 hour
- Medium initial price and low life cycle costs
  (media pad change every 3 months in Singapore city bus application)
CLEAN AIR BY EBERSPÄCHER
LEVEL 3

UV-C LED
AIR STERILISATION
AIR STERILISATION

Why UV-C?

- UV-C radiation (also known as germicidal or microbicidal radiation) that results in the inactivation of microorganisms and viruses as used in hospitals for many years

Why LED?

- Led lights are known for their reliability and long life
- UV-C can also be produced from low pressure mercury vapour lamps, but these were not considered for bus use due to:
  - durability
  - safety concerns if they are broken
  - production of ozone as they ‘warm up’
  - Drifting away from UV-C to UV-B or UV-A as they age
  - heat generation
UV-C LED

- Eberspächer uses a modular UVC-LED solution using modules of different lengths
- They can be fitted inside the AC unit (typically before the heat exchangers) or within the air channel of the bus
- When fitted inside the AC unit, they sterilise both fresh and recirculation air
  - Minimum power consumption: 0.8 Amp 24VDC per module
  - The UV-C LED module is not a filter: therefore a filter is still required. (It is possible to keep the existing foam filter and service intervals do not need to change)
- Only maintenance required is to periodically clean the profile with a soft brush
- Affordable initial cost with no servicing costs
UV-C LED

Proven effectiveness against viruses, validated by:

- Well reputed Guangdong Centre of Microbiology
  - Influenza virus H1N1
  - Influenza virus H3N2

- Perfectus Biomed (UK test laboratory)
  - Human coronavirus 229E
  - Human rhinovirus (common cold)
  - Murine norovirus (winter sickness bug)

Calculated bus air disinfection times based on measured irradiance:

- Time (minutes) to disinfect 47 m³: assumed internal volume of a 12 m bus
- Log 3 (99.9 % de-activation)
- Log 1 (90 % de-activation)

AC unit Airflow in bus: m³/hour (cfm)
CLEAN AIR FOR INDIAN BUSES
Viruses are transmitted by people coughing and sneezing

Smaller particles are atomised and our solutions concentrate on the treatment of these particles in the air.

A well maintained AC unit can help reduce the virus concentration in the bus and actually make bus environment a safer place to be.

Eberspächer solutions:

1. We treat 100% of the air moving in the AC unit.
2. We have different solutions for different climate zones around the world:
   - Different levels of air treatment
   - Different life-cycle costs
YOUR CONTACTS

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