RENSAIR

rensair.com

Rensair real-life air purification trial at QPCS school, London, UK

INDEPENDENT TRIAL CONDUCTED BY

QPCS

AIDED BY MONITORING FROM

AIRTHINGS | FOR BUSINESS

PARTICIPANTS

The participants in this independent, real-world indoor air quality trial were:

ORGANISER

Queens Park Community School is a mixed secondary school and sixth form with academy status. Located in North West London, UK, it has 1,300 students.

More information:
qpcs.brent.sch.uk

MONITORING

Airthings is a global technology company on a mission to ensure that people around the world take control of their air quality through simple, sustainable and accessible technology solutions.

More information:
airthings.com/business

AIR PURIFICATION

Rensair is a specialist in portable air purification, using HEPA filtration and germicidal UVC light to trap and destroy harmful particulate matter.

More information:
rensair.com

Rensair provided the air purifiers for this trial, which was conducted exclusively by Queens Park Community School in collaboration with the School Business Manager and the Head of Science.

EXECUTIVE SUMMARY

A real-life air purification trial was undertaken at QPCS school in London during a 4-week period during February and March 2022.

High quality sensors measured the environment of two poorly ventilated classrooms, providing Particulate Matter (PM 1 and 2.5), CO_2, Noise and Temperature readings. Each classroom was occupied by ~30 students and one teacher during most lessons.

The results demonstrated that a single Rensair air purifier successfully kept airborne Particulate Matter at negligible levels, well below the safety thresholds recommended by leading health authorities. The noise generated by the Rensair unit was significantly lower than the ambient noise of each classroom. Understandably, given the poor ventilation, CO_2 levels in each classroom rose markedly during lessons, an issue easily remedied with periodic natural ventilation.

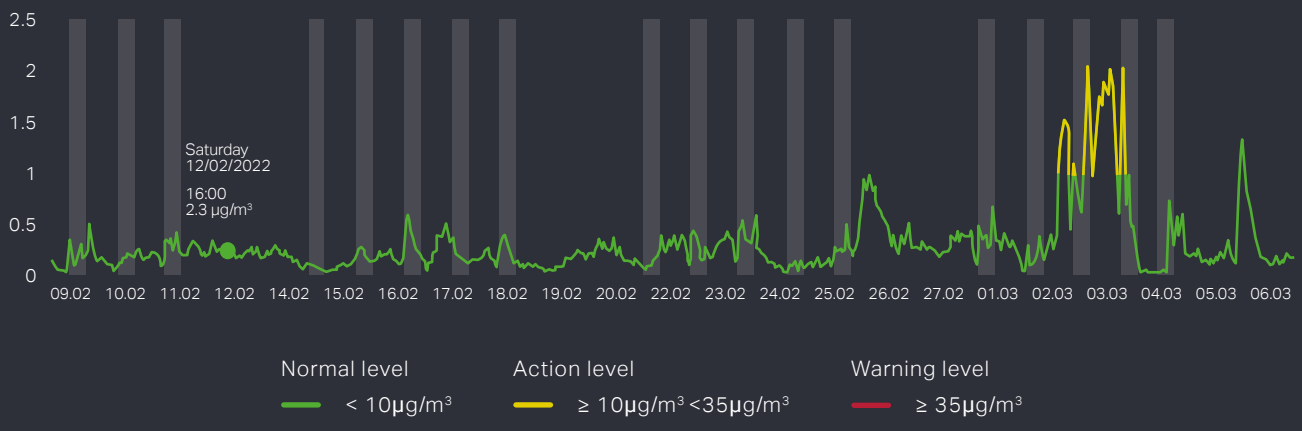
In theory, the cubic meterage and high occupancy of the trial classrooms would have required three Rensair air purifiers per classroom to achieve the WHO's recommended ventilation/purification rate of 10 litres per second per person. In practice, however, one single Rensair air purifier per classroom managed to keep Particulate Matter levels close to zero.

This real-life trial demonstrates that infection mitigation is achievable at a relatively low cost, an important aspect for schools with stretched budgets. Furthermore, there is a significant energy saving for the school as windows are no longer required to be fully opened throughout the school day, which also results in a more comfortable teaching environment for staff and pupils.

PM2.5

Average within opening hours
3µg/m³

Average value
3µg/m³



PM is often brought into the building from outside. Exposure can trigger asthma and allergies, as well as cause irritation of eyes, ear, nose and throat. High levels can indicate problems with your filters or ventilation system.

OBJECTIVE

Rensair, expert in portable hospital-grade air purification for the education sector, staged a real-life trial at Queen's Park Community School (QPCS) in Brent, London.

The objective of the trial was to demonstrate the effectiveness of Rensair technology in removing Particulate Matter, including airborne viruses and bacteria, from high occupancy and poorly ventilated classrooms, without causing noise disturbance.

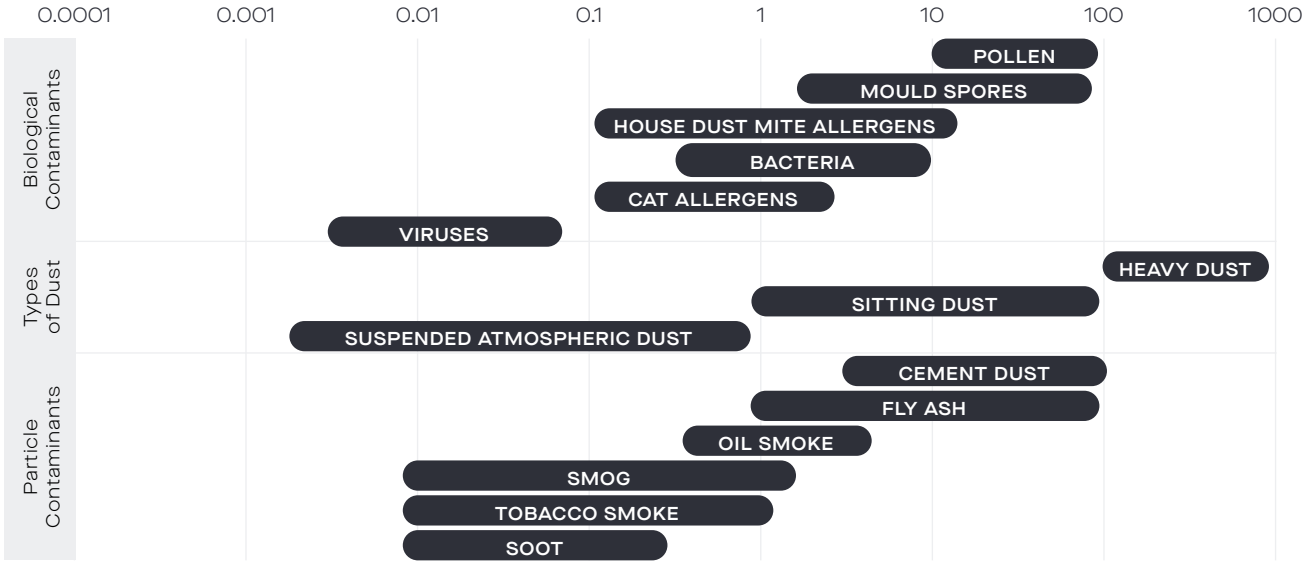
The direct benefit of the Rensair unit is to reduce the risk of airborne disease transmission, but also to improve room comfort and to reduce energy consumption, allowing classroom windows and doors to not remain permanently open.

WHAT IS PARTICULATE MATTER (PM)?

PM is a mixture of solid particles and liquid droplets found in the air that are in most part invisible to the naked eye. The size of PM is measured in microns (µg) – 1,000 microns make up 1 millimetre (mm). PM1 refers to Particulate Matter that is up to 1 micron in diameter, PM2.5 is up to 2.5 microns in diameter and PM10 is up to 10 microns in diameter.

Disease can be transmitted by the inhalation of airborne bacteria and viruses, with the most serious illnesses occurring when microscopic PM aerosols penetrate deep into the lungs. The table below shows the size of various PM matter in microns.

Independent tests show that Rensair units are effective at cleaning particles as small as 16 nanometres (equivalent to 0.016 of a micron – 0.016 µg). The trial sought to establish the effectiveness of a Rensair unit at maintaining a low level of Particulate Matter in a poorly ventilated classroom with high occupancy.



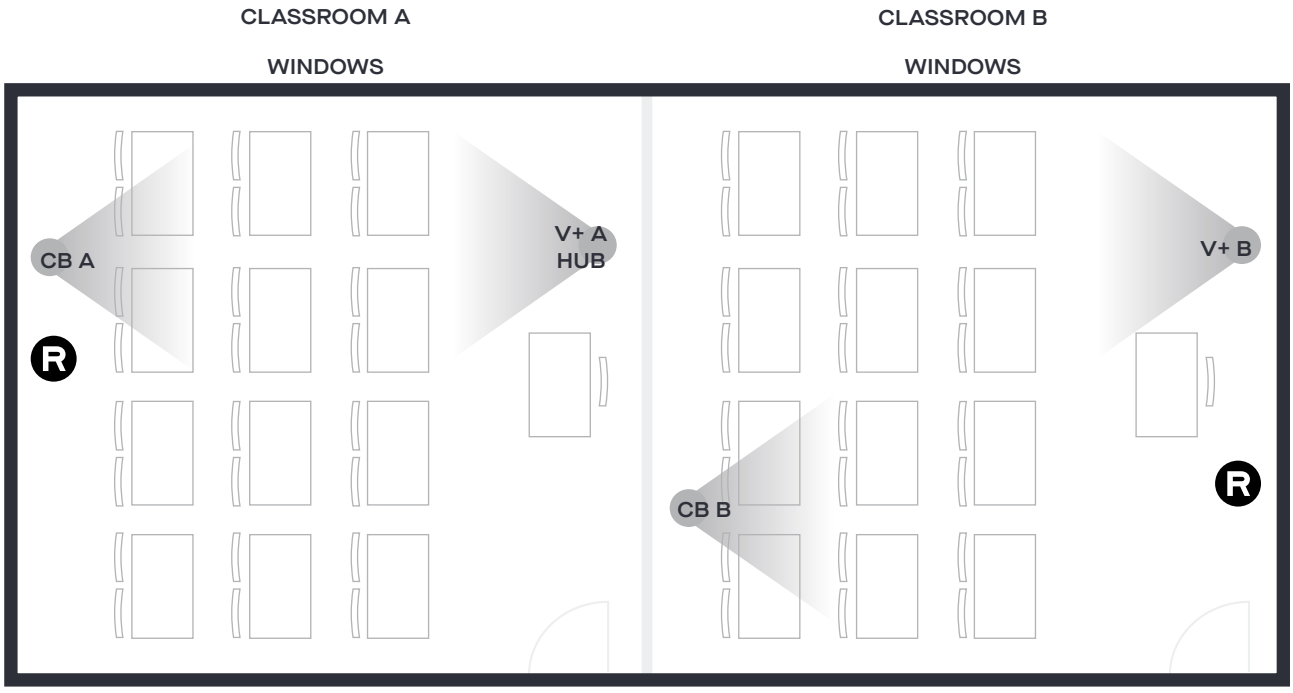
METHODOLOGY

One Rensair air purifier was placed in each of two classrooms to clean the air. One Rensair unit was placed at the back of Classroom A and in Classrooom B a Rensair unit was placed at the front, close to the teacher – this was to see if there would be any difference in data according to where the units were placed.

Each classroom was equipped with two high quality Airthings sensors, located far away from each other and from the Rensair unit. They provided very regular real time data on Particulate Matter, Temperature, CO_2, Noise, Humidity and Light.

The units were operated only between 9am and 5pm during the Monday-Friday teaching week (i.e. not at night, weekends or half term). This was to mimic real life operations, where using the units only when rooms are occupied can extend the life of a Rensair filter to 4.5 years before it needs to be replaced (the H13 HEPA filter and UVC light only need to be changed every 9,000 hours).

FLOOR PLAN AND EQUIPMENT



Airthings Sensors

Rensair Air Purifiers

QPCS Classroom Area

HUB Airthings Communications Hub

V+ Airthings View Plus Sensor

CB Airthings Cloudberry Sensor

Results

REAL-LIFE TRIAL DATA: CLASSROOM A AND B

Note that the vertical grey columns in the following charts represent the hours during which the Rensair units were in operation.

Data variation.
The sensors in the two different classrooms showed minimal variation in the regular measurements (c. every three minutes) taken by each sensor. Each sensor registered the same very low average levels of PM with little discrepancy between sensor readings over the four weeks. This confirms that a Rensair unit generated good airflow in the classrooms, necessary to clean all the air in the room. This corroborates the independent tests carried out by Norconsult in a 93m³ room.

PM1

Average within opening hours: 2µg/m³

Average value: 2µg/m³

VALUES WITHIN OPERATING HOURS	MEASUREMENT (µg/m³) AVERAGE	LOWEST	HIGHEST
CB Classroom A	1	0	4
CB Classroom B	2	0	5
View Plus Classroom A	2	0	8
View Plus Classroom B	2	0	9

PM is often brought into the building from outside. Exposure can trigger asthma and allergies, as well as cause irritation of eyes, ear, nose and throat. High levels can indicate problems with your filters or ventilation system.

Normal level — < 10µg/m³

Action level — ≥ 10µg/m³ <35µg/m³

Warning level — ≥ 35µg/m³

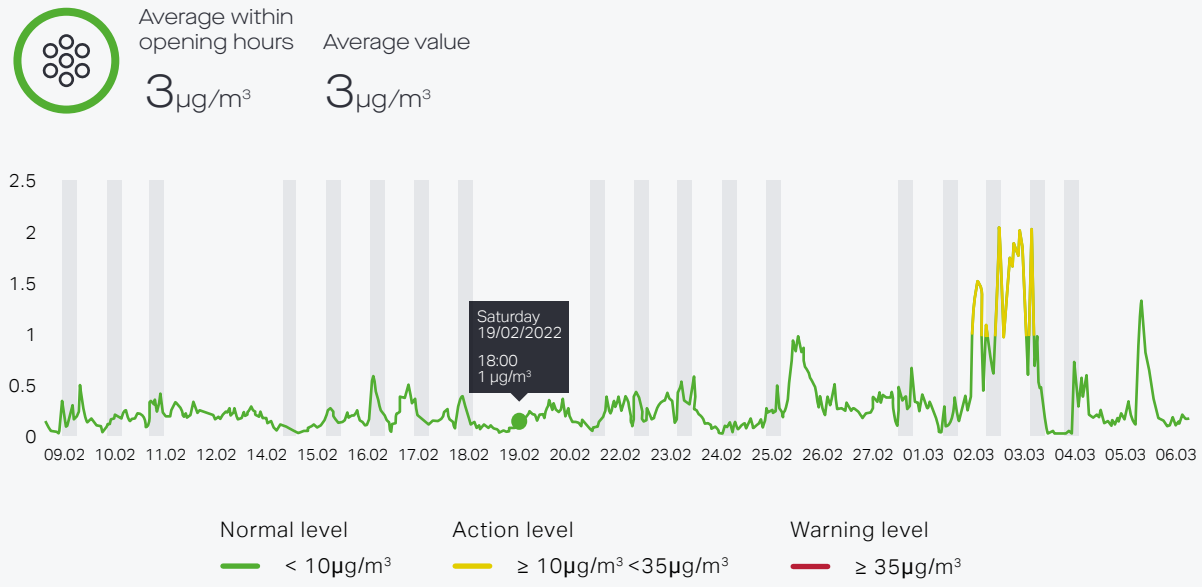
PM1

THE CHART SHOWS THAT THE AVERAGE PM1 READINGS ARE AT NEGLIGIBLE LEVELS

There are no Indoor Air Quality standards specifically for fine PM1 particles. The chart shows that the sensor readings of PM1 have been negligible during school hours, averaging 3µg/m³ throughout the trial.

The PM1 readings registered a rise on the 2nd and 3rd March and the school was alerted.

The cause was unknown, as no unusual work was being carried out at the school and outdoor air monitors registered that outside PM readings on those days were well within the previous month's readings. Note that when the units were in operation (vertical columns), the PM1 readings reduced significantly compared to the readings outside of school hours.



PM is often brought into the building from outside. Exposure can trigger asthma and allergies, as well as cause irritation of eyes, ear, nose and throat. High levels can indicate problems with your filters or ventilation system.

PM2.5

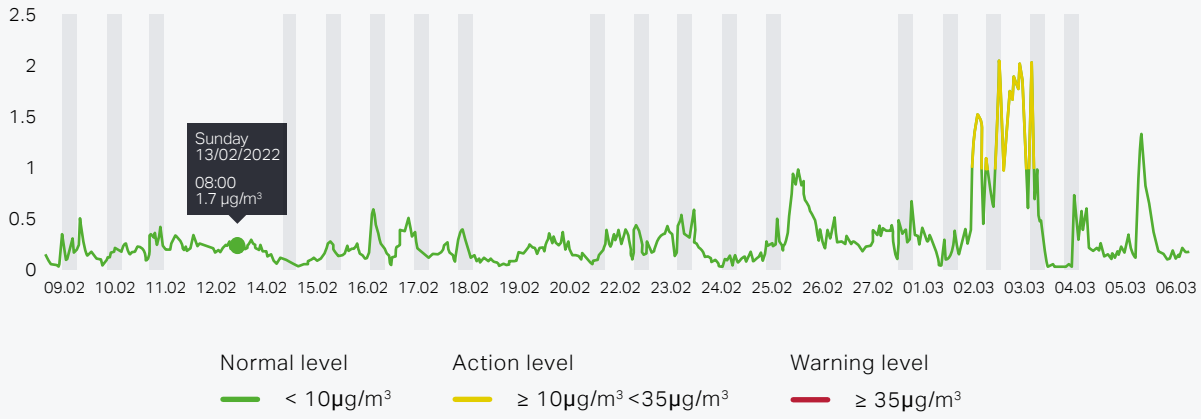
THE CHART SHOWS THAT THE AVERAGE PM2.5 READINGS ARE AT NEGLIGIBLE LEVELS

The EU Air Quality standard is for PM2.5 to remain below 20 microns per cubic metre (µg/m³), while the guideline limit in the UK is 25µg/m³. The WHO recommends a more stringent limit of 15µg/m³, with the Taskforce for Lung Health advocating an even lower target of 10µg/m³.

The average PM2.5 readings throughout the trial was 3µg/m³ during school hours. Similar to PM1, there was a two day rise in PM2.5 reading, although it remained low during school hours when the Rensair units were operating.

Average within opening hours
3µg/m³

Average value
3µg/m³



PM is often brought into the building from outside. Exposure can trigger asthma and allergies, as well as cause irritation of eyes, ear, nose and throat. High levels can indicate problems with your filters or ventilation system.

CO_2

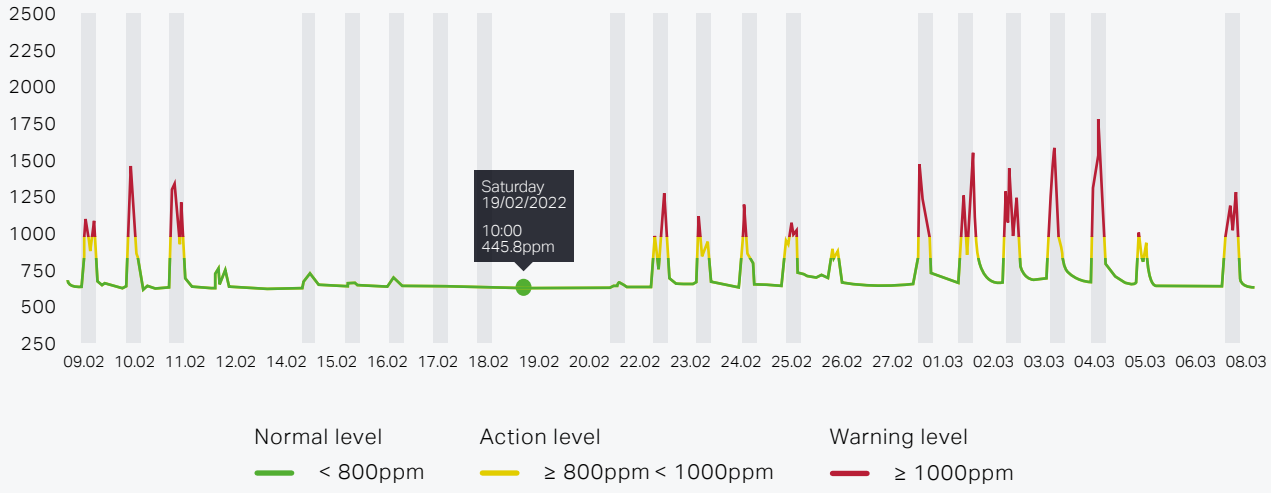
CO_2 ROSE SUBSTANTIALLY DURING LESSONS DUE TO THE HIGH OCCUPANCY OF THE POORLY VENTILATED CLASSROOMS

The UK HSE recommends CO_2 levels to remain below 800 parts per million (ppm). As can be expected in poorly ventilated classrooms, CO_2 levels will increase when there is very high occupancy. CO_2 in itself will not cause harm and is a vital part of the environment, but research shows that high concentrations can reduce cognitive functions.

The important conclusion is that the classrooms are indeed poorly ventilated, with little introduction of fresh outside air. But the Rensair units nevertheless managed to keep PM levels, which include Covid viral particles, at negligible levels.

Average within opening hours
873ppm

Average value
602ppm



Carbon Dioxide (CO_2) is an important consideration when it comes to comfort and productivity. Air with high levels of CO_2 can lead to difficulty concentrating, decreased cognitive ability and fatigue. Typically, CO_2 levels outdoors are around 400 parts per million (ppm). Concentrations below 800ppm are considered ideal for healthy and productive workspace. To reduce your CO_2 levels increase workspace ventilation.

Noise

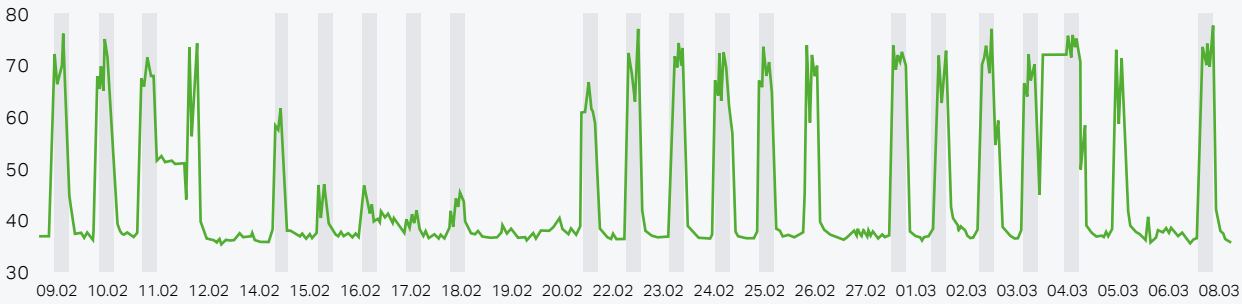
THE REGISTERED CLASSROOM NOISE WAS SIGNIFICANTLY HIGHER THAN THE OPERATING SOUND GENERATED BY THE RENSAIR UNITS

From an engineering perspective, it is hard to design an effective air purifier that does not generate noise, but excess sound would be a distraction in a learning environment. The Rensair unit was operated on the medium fan setting in both classrooms, purifying 430m^3 of air per hour at a noise level of 52dBA. The dBA charts demonstrate that the ambient noise in the classroom was well in excess of the noise generated by the Rensair unit, confirming teacher feedback that the units are not a distraction.

Note that this chart clearly shows that the Rensair units were not in operation in the evenings, weekends or half-term (14-18 Feb).

Average within opening hours
59dBA

Average value
46dBA



Noise levels (dynamic range 35-120dBA SPL) can be useful to get an overview of noise trends inside a building.

Temperature

THE TEMPERATURE READINGS REGISTERED A COMFORTABLE AVERAGE OF 21°C IN EACH CLASSROOM, WITH HIGH AND LOW READINGS OF 18 AND 23 DURING THE TRIAL PERIOD

Average within opening hours	Low Reading	High Reading
21°C	18°C	23°C

This is decidedly warmer compared to when classrooms had windows and doors permanently open (i.e. before the Rensair units were installed).

CONCLUSIONS

It is clear from the data that Rensair technology effectively filters and keeps Particulate Matter, including airborne viruses and bacteria, at very low levels in the two high occupancy, poorly ventilated classrooms, without causing noise disturbance.

As can be seen from the two day instance of high background Particulate Matter, the use of Rensair units substantially reduced the PM1 and PM2.5 levels in both classrooms to within safe limits during school hours.

To combat the high CO_2 readings, Rensair has recommended that the classrooms are aerated between lessons to introduce fresh air and reduce the CO_2 levels, while limiting the impact of cold outside air on classroom temperature.

RENSAIR

For more information:

– TYPE
contact@rensair.com

– TALK
+44 (0)20 3973 8927

– CLICK
rensair.com