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- Healthcare
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Case Study:

WALL SPLIT SYSTEM COIL REMEDIATION IMPROVES INDOOR AIR QUALITY & PERFORMANCE

Regular maintenance and cleaning of wall split air conditioning systems can have a direct impact on operating costs by saving energy, whilst providing cleaner and healthier air to building occupants.

Dirty air conditioner coils can become breeding grounds for macromolecular organic dust – a result of mould, fungi and bacteria growth in the system. This reduces efficiency and increases running costs. The high levels of bacteria and mould, in particular mycotoxins, may have a harmful effect on human health. This may place vulnerable building occupants, such as in nursing homes and schools, at risk of infection through inhalation of airborne contaminants.

In this case study, coil remediation was performed for a 7.2kW wall split system. The coil performance and bacteria levels were analysed pre- and post-remediation.

Project deliverables:

IMPROVED COIL HEAT TRANSFER EFFICIENCY

- **21.7%** air flow **improvement**
- **15.6% improvement** in coil temperature differential

IMPROVED INDOOR AIR QUALITY

- Bacteria levels **reduced**
- **Reduced** mould and fungi

WALL SPLIT SYSTEM COIL REMEDIATION CASE STUDY

Commercial air conditioning systems should be maintained in accordance to AS/NZ 3666.2[2] which requires monthly inspections of coils and cleaning as required. Despite this, many wall split systems in offices, schools, nursing homes and domestic settings often miss out on regular maintenance and cleaning.

More proactive owners may notice a drop in performance and clean the filter as a consequence, but typically wall split systems are 'set and forget'. Over time, the build-up of dirt, grime, mould and bacteria on the filters, coil and within the condensate drain and pan leads to:

- Poorer cooling and/or heating performance
- Higher energy consumption
- Greater concentration of potentially harmful indoor air contaminants

A number of studies have shown that clean coils (including coils remediated to their original specified condition) improve performance, by increasing the effective heat transfer area, removing obstructions to airflow resulting in more effective cooling or heating, improved humidity control and improved indoor air quality. [3, 4, 5]

THE PROJECT

The case study was conducted for a wall split air conditioner in a residential application. It is typical of many commercial or residential installations where the unit has not been regularly maintained.

The project involved coil remediation using AerisGuard™ anti-microbial multi-enzyme cleaners and treatments.

The trial measured the bacteria and mould levels of the air conditioner before and after coil remediation to demonstrate the effectiveness of AerisGuard™ in reducing contaminant levels. Coil airflow and temperature was also measured to assess heat exchanger performance.

THE EQUIPMENT

The trial was carried out on a Kelvinator 7.2kW wall split system.

The unit was 4 years old and had been poorly maintained. The condition of the air conditioner was assessed as poor, with external filters blocked and a considerable amount of dirt throughout the air conditioner coils.

The unit was set to 23°C for the duration of the tests.

THE PROCESS

The following variables were measured pre- and post-remediation:

- Air on and air off temperature of the coil.
- Air velocity of the coil.
- Microbial count.

As part of the validation process swab tests on the air conditioning equipment and indoor air samples were taken pre- and post-remediation.

The samples were then tested by an independent laboratory, MouldLab in Newcastle, NSW.

Anemometer readings measured the air flows in and out of the unit as well as equipment operating temperatures.

1 Establish baseline for uncleaned air conditioner coil → **2** Conduct Coil Remediation with AerisGuard™ anti-microbial cleaners and treatments → **3** Measure post remediation performance of clean coil

Image 1: Prior to cleaning

Image 2: Cleaning process

The unit was isolated at the main switchboard and the internal controls and wiring were protected to ensure no water damage can occur. A specialised collection bag is then attached to the unit to capture any waste and debris from the cleaning process.

The enzymes are activated by adding lukewarm water to the AerisGuard™ Coil Cleaner concentrate. This solution is sprayed directly onto the air conditioning heat exchange coil.

The unit was left for 20 minutes for the enzymes to take effect and then lightly cleaned with hot water to remove the dirt and grime. The unit is then simply left to dry.

The coil is then treated with AerisGuard™ Bioactive Coil Treatment to prevent microbial growth for up to 12 months.

Image 3: Post clean

THE RESULTS

VERY HIGH LEVELS OF BACTERIA PRIOR TO CLEANING

MouldLab reported that the levels of bacteria and mould were measured to be in the very high range of >500 cfu/plate for coil air off and >250 cfu/plate for coil air on. At this very high level, immediate remediation is recommended. Typically, this is seen as biofilm that builds up within the unit.

Whilst surface mould levels were rated as normal, the types of mould detected included species which have been shown to be:

- Immuno-compromising and/or
- Allergenic and/or
- Mycotoxin producers.

Mycotoxins, which can have harmful effects on human health, are produced by the digestion process of some moulds and are typically ingested by humans, but may also cause infection through skin contact or inhalation of airborne contaminants.

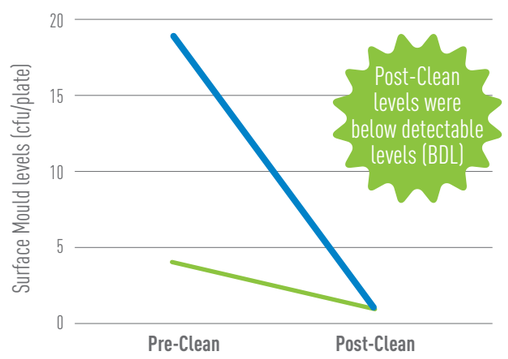
AERISGUARD™ EFFECTIVELY REMOVED BACTERIA AND MOULD

Following remediation, samples were again taken and tested to determine the presence of mould and bacteria both on the equipment and within the air conditioned space.

Post clean, MouldLab reported that bacteria and mould levels to be very low or below detectable levels (BDL) concentrations.

Surface Bacteria levels
Pre-Clean vs Post-Clean

Surface Mould levels
Pre-Clean vs Post-Clean



COIL REMEDIATION ACHIEVED IMPROVED AIRFLOW AND TEMPERATURE DIFFERENTIALS

Airflow and temperature measurements taken pre and post remediation demonstrate the benefits of coil remediation on system performance.

Effective heating and cooling relies on a combination of convective and conductive heat transfer between the air stream through the coil, the coil itself and the refrigerant in the coil. As coils become blocked with dust, grime and biofilm, the pressure across the coil increases and airflow decreases. This reduces the effective heat transfer efficiency of the system.

In addition, biofilm on the coil produces an insulating effect, reducing the conductive heat transfer efficiency and further reducing coil performance.

The combined impact on the system is reduced airflow, higher energy consumption and inability to meet desired comfort conditions.

AerisGuard™ anti-microbial multi-enzyme technology safely cleans and removes contamination from coils at the same time as providing protection from recontamination.

As the following results show coil remediation improved the average airflow into the air conditioning unit by 9.2%, the average air flow out of the air conditioning unit by 21.7%, and the temperature differential across the coil by 15.6%.

Coil Air Flow

	Pre Clean	Post Clean	Improvement
Average Air Velocity on (m/s)	1.5	1.7	9.2%
Average Air Velocity off (m/s)	2.4	2.9	21.7%

Coil Temperature

	Pre Clean	Post Clean	Improvement
Average air on temperature (°C)	20.8	22.8	
Average air off temperature (°C)	11.7	12.4	
Temperature differential (°C)	-9.1	-10.4	15.6%

PROJECT DELIVERABLES

This case study demonstrates the importance of regular cleaning for wall split systems.

Cleaner coils result in better heat exchanger performance and reduced running costs, as well as providing building occupants with cleaner and healthier air.

1. Field Assessment of Fungistatic and Bacteriostatic Efficacy of AerisGuard™ Bioactive Coil Treatment, June 2006, Novapharm Research (Australia) Pty Ltd
2. AS/NZS 3666.2:2011 Air-handling and water systems of buildings—Microbial control. Part 2: Operation and maintenance
3. "Clean HVAC System Coils Save Energy" Sheppard, Robert. www.buildings.com/articledetails/ articleid/8282/title/clean-hvac-system-coils-save-energy.aspx
4. Guide to Best Practice Maintenance & Operation of HVAC Systems for Energy Efficiency, Department of Climate Change and Energy Efficiency, 2012
5. Study Verifies Coil Cleaning Saves Energy, Ross
6. MouldLabs Report