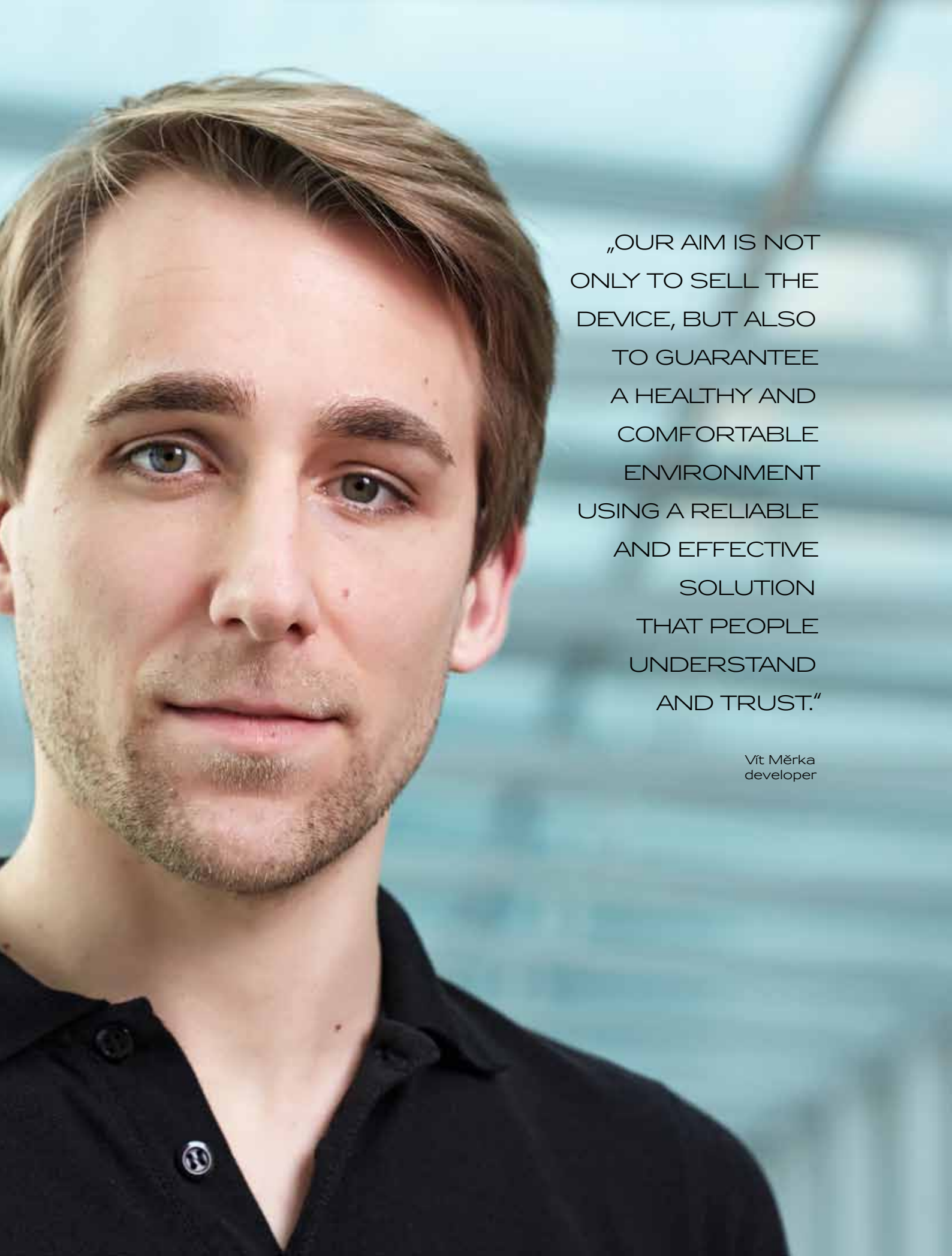
REMAK

CLEANROOM AND HEALTHCARE



„OUR AIM IS NOT ONLY TO SELL THE DEVICE, BUT ALSO TO GUARANTEE A HEALTHY AND COMFORTABLE ENVIRONMENT USING A RELIABLE AND EFFECTIVE SOLUTION THAT PEOPLE UNDERSTAND AND TRUST."

Vít Měrka
developer

AND THEREFORE...

We have designed our hygiene units so that:

- they will provably lower the content of microorganisms and contaminants in the ventilated room,
- they will provide comfortable control of temperature and humidity,
- they will provide safe and repeated sanitation in the shortest possible time,
- they will minimize technological downtimes due to maintenance or repairs.

The work performance of personnel, patient satisfaction and the overall capacity of sanitary facilities will be improved thanks to this efficient device.

We exclusively cooperate with designers and installers who we trust and who prove the required qualifications during periodic training courses.

To be sure, we provide supervision over the maintenance, installation and thorough operating training for every hygiene unit we deliver.

We comply with all legislative requirements and industry good practice, and we are a reliable partner with Eurovent certification.

GUARANTEE OF COMPLIANCE WITH STANDARD REQUIREMENTS AND GOOD PRACTICE

- **EN 13053** (Ventilation for buildings – Air handling units – Rating and performance for units, components and sections)
- **DIN 1946-4** (Ventilation and air conditioning)
- **EN 1886** (Ventilation for buildings – Air Handling Units – Mechanical performance)
- **VDI 3803** (Raumlufttechnik, Geräteanforderungen)
- **VDI 6022** (Raumlufttechnik, Raumluftqualität)
- **AHU Guideline 01** (General requirements for Air Handling Units)
- **DIN EN 1751** (Ventilation for buildings – Air terminal devices – Aerodynamic testing of damper and valves)
- **EN 13779** (Ventilation for non-residential buildings – Performance requirements for ventilation and room-conditioning systems
- Includes compliance with national directives and regulations, e.g. UK (HMT03), etc.

AIR-HANDLING SYSTEMS FOR CLEAN FACILITIES

AIR-HANDLING SYSTEMS FOR CLEAN FACILITIES

CHARACTERISTICS

- Enable fast, safe and periodic **thorough sanitation** of all the air-handling device parts
- Comply with all the **legislative requirements and industry good practice**
- **Minimise operating costs** using effective technologies

Facilities with special demands for cleanliness are called hygiene or sometimes clean plants. Health facilities and laboratories, semiconductor production and the pharmaceuticals industry are typical examples of hygiene plants.
Hygiene plants require a wholesome and comfortable environment, and an air-handling system is the only tool enabling these objectives to be achieved. A wholesome and comfortable environment in hospital helps to shorten stays of patients and aids more efficient and quality work by physicians and other medical personnel. This results in greater patient satisfaction as well as greater capacity of the health facility.

SUMMARY OF KEY FEATURES

- Lowering the contents of microorganisms and contaminants
- Temperature and humidity control
- Removing bad odours

A PROPERLY FUNCTIONING AIR-HANDLING SYSTEM WILL RESULT IN:

- Shorter maintenance time
- Proper environmental parameters thanks to the possibility to perform proper maintenance
- Minimum risk of technology process contamination due to maintenance
- Faster healing process in patients
- Greater capacity of the heath facility due to shorter patient stay in hospital

HYGIENE AND NORMAL ZONES IN A HOSPITAL FACILITY

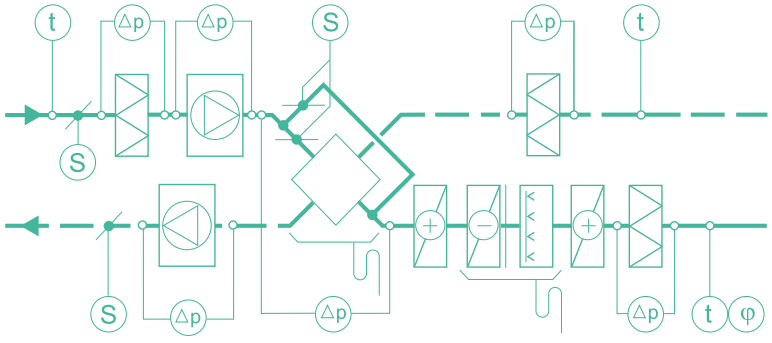
HYGIENE VS. NORMAL ZONES IN A HOSPITAL FACILITY		
DEPARTMENT	**HYGIENE VERSION**	NORMAL VERSION
Surgical ward (operating theatres, operating theatre rear areas, patient recovery, operating theatre accessories – entire ward)	×	
Intensive Care Unit (ICU) (in-patient rooms, their rear areas, nurse room, stores, washrooms, cleaning room, entire ward)	×	
Angiography (examination room, rear areas)	×	
Urgent admission room (entire ward)	×	
In-patient ward (entire ward)	×	
Sterilization (clean side, dirty side – setting, washing, entire ward)	×	
Examination rooms, out-patient departments	×	
Isolation ward, incl. waiting rooms	×	
Indoor corridors and waiting rooms of health facilities		×
Staff changing rooms		×
Inspection rooms, incl. rear areas		×
Clinic administration		×
Radiodiagnostic departments (MR, CT, SPECT, RTG, SONO, etc.)	×	
Diagnostic departments (bronchoscopy, laparoscopy, colposcopy, etc.)	×	
Laboratories (all types)	×	
Clinical biochemistry departments (entire department)	×	
HAEMODIALYSIS DEPARTMENTS (ENTIRE DEPARTMENT)	×	
Clinical biochemistry departments (entire department)	×	
Anatomy-pathology departments (entire department)	×	
Radiopharmaceutical departments (entire department)	×	
Linear accelerators, irradiation rooms (nuclear medicine department)	×	
Sterile medicament preparation department (entire department)	×	
Department of health aids		×
Pharmacies (medicament and solution preparation)	×	
Pharmacies (stores, dispensary)		×
Transfusion departments (blood taking, semi-sterile waiting room, rest room, rear areas, store, entire department)	×	
Rehabilitation department		×
Central warehouse		×

CONSTRUCTION OF OUR HYGIENE UNITS ENABLES SECURE AND REPEATABLE SANITATION IN THE SHORTEST POSSIBLE TIME AND MINIMIZES TECHNOLOGICAL SHUTDOWNS DUE TO MAINTENANCE OR REPAIRS.

BASIC INFORMATION AND RECOMMENDATIONS

AS THE FOLLOWING LIST CANNOT BE COMPLETE, IT INCLUDES JUST BASIC INFORMATION AND RECOMMENDATIONS TO SIMPLIFY IT

- Outdoor location of air-handling units significantly complicates sanitation and diminishes results as far as device cleanliness. Noise and condensation during extreme frost are additional reasons to avoid outdoor installation as much as possible. If it is necessary to use outdoor units, they must be equipped with free chambers for the location of direct heaters, steam generators, control nodes and heating; stench traps must also be fitted with heating cables.
- Install only heat-recovery (not regeneration) exchangers to ensure separation of inlet and relief air.
- Due to hygiene reasons and to decrease demands for maintenance, it is advisable to situate the fans so that air suction through leakages on the low-pressure side of the unit are minimised.
- It is advisable to situate the fans in front of wet components of the unit so that the siphon for the condensate drainage is situated on the „high pressure" side of the unit.
- Service chambers should be inserted in front of and behind the heat exchangers.
- The unit's closing dampers must ensure the unit is closed (e.g. using an actuator with a spring) in case of a power failure.
- Internal areas of the air-handling unit can be contaminated by microbial growth at temperatures above 0°C and relative humidity above 80 %. Humidity higher than 90 % can cause problems in filters and attenuators even if humidity has risen for only a short period of time.



RECOMMENDED COMPOSITION OF AIR-HANDLING UNITS EQUIPPED WITH A HEAT-RECOVERY EXCHANGER

BASIC INFORMATION AND RECOMMENDATIONS

If high humidity at this temperature level persists for a longer time period, suitable measures must be taken to eliminate microbial growth, especially on the filters and attenuators, for example, by inserting the pre-heater in front of the filter to increase the inlet air temperature by about 3 K.

- Air mixing can only be used if the inlet air is not contaminated by inlet air (odours, gases, etc.). Intensive recirculation is used in rooms with biological factors (BSL rooms – Biological Safety Level 1 to 4), e.g. burn departments and burn ICUs.
- Air mixing must allow the amount of fresh inlet air to be at least 50% of the total air flow and simultaneously ensure 100% air recirculation (e.g. warm air heating, emergency preventing contamination of the internal area by outdoor air, etc.).
- The amount of fresh inlet air is dependent on the given situation.
- The mixing ratio must always be set so that the final air mixture temperature is above zero and its relative humidity must not exceed 80 %. Air mixing cannot be used for other states of the final air mixture. There is a risk of air humidity condensation, respectively frost build-up.
- Air flow rate control dependent on the system's pressure sensor readings.
- The nominal fan air output must be dimensioned for mean fouling of each filter situated in the air-handling unit.
- Air-handling devices must be stored in places protected against the effects of outdoor weather conditions, and protective packaging can only be removed just before installation.
- When stored, all components must be protected against contamination and damage.
- Any additional and sealing material used during installation must comply with the requirements of the air-handling device's manufacturer.
- Once installation has been completed, the entire device must be inspected and cleaned.
- The upper limit of pathogenic bacteria must not exceed 10,000 cfu/ml when a check smear is taken. This value must not be exceeded in the entire internal area of the device.
- As far as the humidification chambers, coolers and condensate drainage trays are concerned, if concentrations higher than 1,000 cfu/m^3 (100 cfu/100 ml for legionella) have been measured, the humidification chambers, coolers and condensate drainage trays must be inspected and cleaned.
- Maximum level of dust accumulation in the device chambers and distribution duct is 0.3 g/m^2 for inlet and recirculated air and 0.9 g/m^2 for relief air.

CLEANABILITY

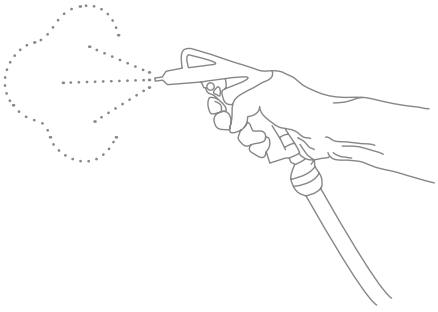
AIMS AND METHODS

The aim of air-handling unit sanitation is thorough cleaning and disinfection, if necessary. Therefore, Remak air-handling units are in all respects designed to be easy to clean using UV radiation and sanitation agents containing hypochlorites (e.g. sodium hypochlorite **NaClO**), **chlorides**, **chlorates**, peroxides (e.g. hydrogen peroxide **H_2O_2**), ozone (**O_3**), etc. *[For a complete list of sanitation agents, please refer to the User Manual].*
The air-handling device is not designed to exhaust aerosols or air with high chemical contamination, respectively air warmer than 45 ºC.

CLEANABILITY MUST BE VERIFIED BY A LABORATORY TEST

Before testing each cleaning method, it is necessary to create an initial state of contamination which can be repeated. Firstly, clean and dry the entire air-handling unit. Seal the end of the air-handling unit with a sealing foil. Tightly connect a foil adaptor to the air-handling unit face and to the fan for the dosing of contaminants.
Fine powder particles dosed into the running fan can be used to contaminate the air-handling unit. The air flow will distribute these powder particles throughout the air-handling unit, including the last chamber. This method of contamination.

COMPRESSED AIR CLEANING



Cleaning is performed using 8-bar compressed air. Compressed air can only be used to remove contaminant from hard-to-access places and to clean components which can be slid out of the unit, such as heat-exchangers. By the effect of compressed air, deposited contaminants are released. During test cleaning, note possible destructive effects on each component of the air-handling unit, such as drop eliminator fins, door sealing, etc.

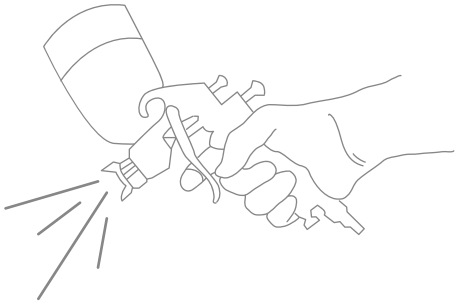
Hygiene versions of air-handling devices must comply with the C class of cleanliness (i.e. high class of cleanliness) in accordance with ČSN EN 15780.
This level of cleanliness must be achieved using common cleaning methods (hand cleaning, pressure water cleaning and compressed air cleaning) without the risk of damage to user health or damage to the environment. Pressure water cleaning can only be used for sections equipped with condensate drainage.

HAND CLEANING

When cleaning, start from the contamination source (fan in the air-handling unit's face) to the end chamber. First, remove the drop eliminators and heat-exchanger from the air-handling unit. Then using a brush, remove coarse dirt and powder clouds from the bottom of each chamber. After that, using a moist cloth wipe clean the surfaces of the chamber roof, walls and bottom of the chamber. Once the chambers have been cleaned, remove dust from the chamber doors. Here, make sure to perfectly clean the door's rubber sealing and remove deposits from the inspection opening sealing.

Cleaning cloths can be caught and torn in these places, the fibres are caught by rivets and screws and there is a risk of injury when handled carelessly.
The condensate drainage trays, including parts below the coolers, must be accessible for cleaning. The gap between the condensate drainage tray and the lower edge of the cooler must allow thorough cleaning as well as visual inspection.

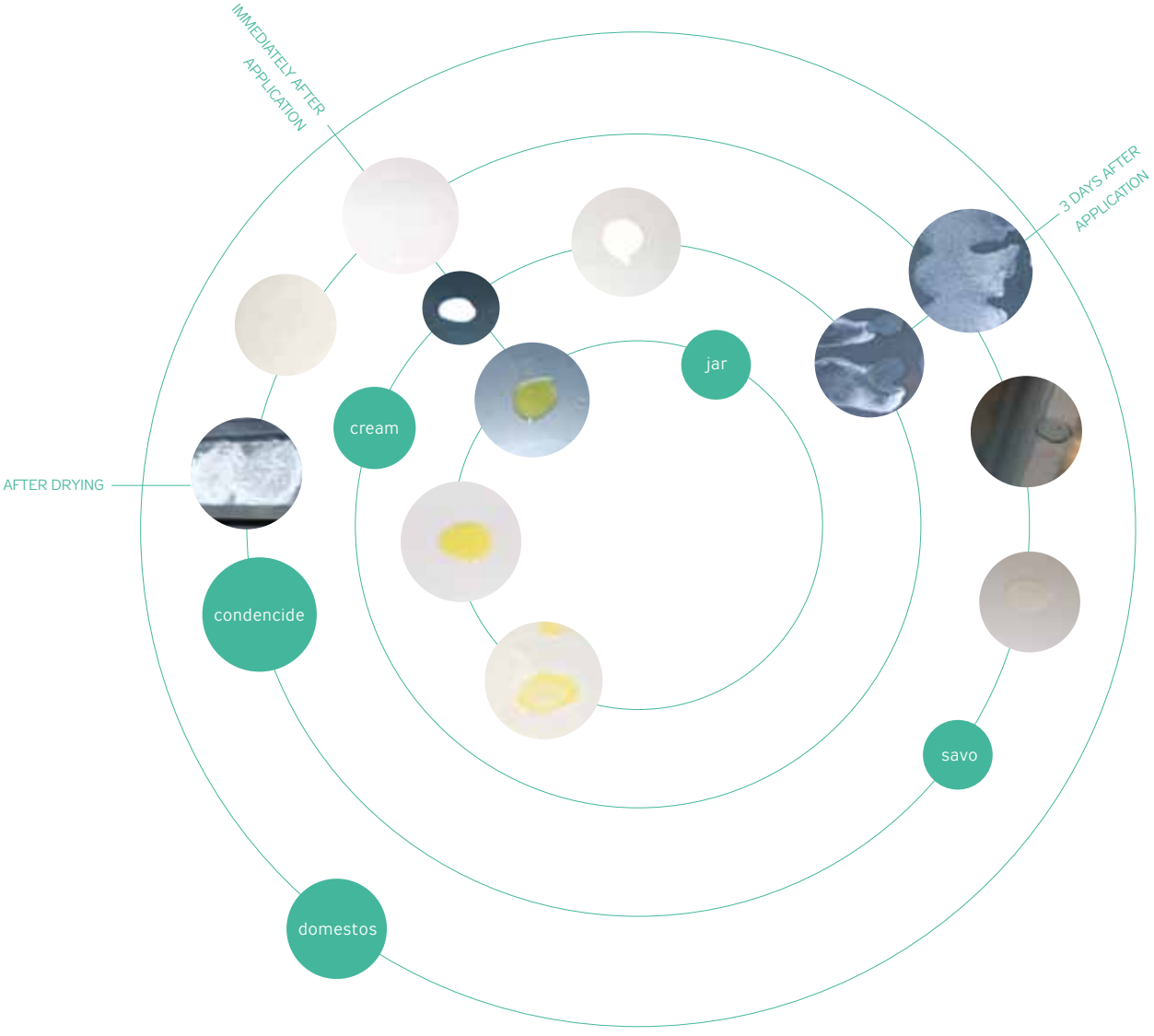
PRESSURE WATER CLEANING (LOW PRESSURE)



Pressure water cleaning can only be used in the unit's chambers which are equipped with condensate drainage trays. Pressure water cleaning cannot be used for other parts of the air-handling unit.
Spray the roof, walls and bottom of the chamber with pressure water and then drain the condensate drainage trays and dry the air-handling unit.

Pressure water can be conveniently used to clean the heat-exchanging surfaces of the heat-exchangers and drop eliminators. During the test, the consumption of water is measured, pressure water effects on the cleaned elements of the air-handling unit are recorded and requirements for the drying of wet parts are assessed.

APPLICATION OF SANITATION AGENTS TO AIR-HANDLING UNIT PARTS



CHEMICAL RESISTANCE

CHEMICAL RESISTANCE

ASSESSMENT OF SANITATION AGENT EFFECTS ON AIR-HANDLING UNIT PARTS

This assessment is performed by the analysis of technical sheets of the used materials and typical cleaning agents used to clean the unit in corresponding classes of cleanliness, for the low to high class. A simplified test can be used for verification purposes. During this test, concentrated sanitation agents are used to verify possible damage to the air-handling unit parts caused by this extreme load and to simulate repeat use of these sanitation agents. An interval of three days is set for concentrated agents to affect the parts and for cyclical cleaning using doses of thinned agents. Visual inspection followed by cleaning with drinkable water is performed after three days/ cyclical cleaning. Then the results can be assessed.

SERVICE LIFE AND RELIABILITY

The service life and resistance of the used materials and surface finishes must be designed with regards to the fact that the corrosion factor in hygiene applications is not air itself but the sanitation process. Therefore, anticorrosion protection must be designed according to the composition of the used sanitation agents and sanitation methods (brushing, compressed air, pressure water, UV radiation) and the greater risk of damage (scratches) due to the movements of persons performing cleaning inside the cleaned devices must also be taken into account.
Sanitation agent solutions usually contain different concentrations of the following substances:

When designing the device, it is necessary to avoid such structural nodes which allow the sanitation agent solutions to leak in and cause corrosion development due to the long-term effects of the chemicals.
The long service life of the casing as well as the high quality of the electrical components is essential for reliable operation of the device, which is often continuous and in hazardous conditions.

When selecting materials, connecting parts and surface protection, preservation of the smoothness of all the sanitized surfaces must also be taken into account. Therefore, it is not possible to use just a protective layer of zinc as this layer will be dissolved when protecting the base material and will create coarse "maps" which cannot be further treated.

HYPOCHLORITES

(e.g. sodium hypochlorite NaClO)

CHLORIDES

CHLORATES

PEROXIDES

(e.g. hydrogen peroxide H_2O_2)

OZONE (O_3) ETC.

ALDEHYDES

HYDROXIDES

THE SUCCESSFUL IMPLEMENTATION OF A HYGIENE AIR-HANDLING SYSTEM REQUIRES HIGH QUALIFICATION OF ALL PARTICIPATING PARTIES, AND MERE KNOWLEDGE OF LEGISLATION IN THIS INDUSTRY IS NOT ENOUGH, IT IS ALSO NECESSARY TO KNOW AND ADHERE TO „GOOD PRACTICE“.

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