



WHEN WATER PROTECTS

The importance of humidity
in the electronics industry

CLIMATE CONTROL

STANDARDISED PRODUCTION

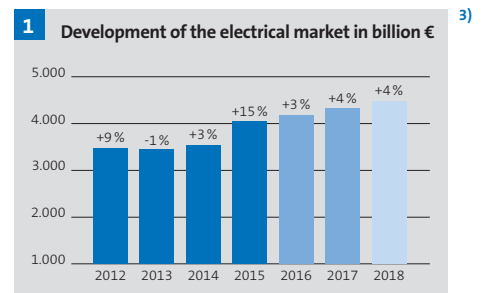
Increasingly sensitive components

Today, the electronics industry is the largest industrial sector in the world. But despite its unprecedented ascendancy and growth year over year, the industry is continuously challenged to face international competition. In this regard it is indispensable to optimise manufacturing, standardise production conditions and have modern building technology with a controlled room climate.

Smaller, faster and smarter: Over the last couple of decades, nothing has impacted our daily lives like the circuit board. Today, more than a quarter of the electrical market pertains to electronic components and semiconductors, which are becoming ever smaller and more powerful. But along with the increasing miniaturisation goes the susceptibility to disturbances in the manufacturing process. Malfunctions or shortened lifespans of semiconductors can only be excluded by comprehensive quality control. The temperature and especially the relative humidity are parameters of a standardised production environment that have a significant impact on the quality of the products.

Protect against electrostatics

One of the fundamental imperatives of almost every electronics company is to protect against electrostatic discharge (ESD). According to leading manufacturers¹⁾, 25% of all identified malfunctions are due to electrostatics. The US-based EOS/ESD Association expects that investments in ESD protection will continue to rise by 2020²⁾ in order to keep up with the increasing sensitivity of the components. A key aspect for every ESD protection program is to manage humidity. Relative humidity has an immediate impact on the dissipation behaviour of materials and components: If the air is too dry, the odds of having to contend with charges increase sharply. At an optimal relative humidity of 40% and 60%, the conductivity of air and material surfaces has increased to the point where electrical charges can easily be dissipated.

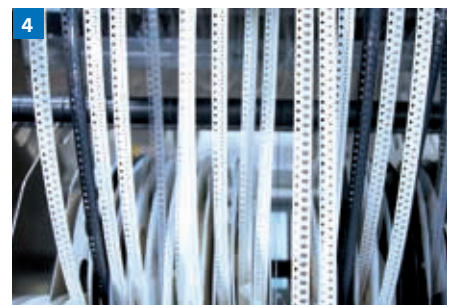
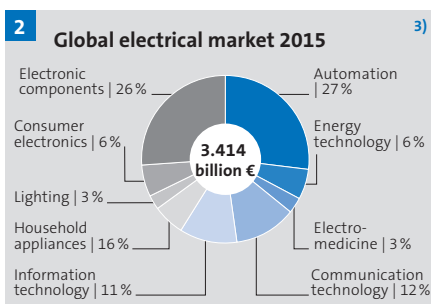


Ensuring quality

Having consistent and optimal air humidity is an important quality factor for numerous other processes. Humidity levels that are too low affect the viscosity of soldering paste and can thereby impair the stability of the soldering process. For glueing, dispensing and varnishing processes, insufficient humidity can lead to adhesion problems. As well electrical and functional tests can not provide reliable results when the air humidity fluctuates.

Healthier environment

Optimal air humidity improves the working conditions of the employees and protects their health: dried up mucous membranes, respiratory disease, burning eyes, nose bleeds and other ailments are prevented and the room air is kept clean and fresh.



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¹⁾ Welsher, T., What is the Real Cost of ESD Damage? InCompliance Magazine (2010)

²⁾ EOS/ESD Association, Inc., Electrostatic Discharge (ESD) Technology Roadmap (2016)

³⁾ ZVEI and International Statistical Offices

Controlled humidity protects

Globally recognised standards are indispensable for quality management. The faster technical progress and global competition are moving forward, the more important it is to have practical standards for achieving optimal quality quickly and at the lowest cost possible. Many relevant standards contain recommendations for controlled humidity.

Standard	Name	Institution
INTERNATIONAL		
IEC 61340-5-1:2016 IEC 61340-5-2:2016	Electrostatics – Part 5-1/5-2: Protection of electronic devices from electrostatic phenomena – General requirements (2016)	IEC International Electrotechnical Commission, www.iec.ch
IPC-J-STD-001F	Requirement for Soldered Electrical and Electronic Assemblies (2014)	IPC – Association Connecting Electronics Industries, www.ipc.org
JESD625B	Requirements for Handling Electrostatic-Discharge-Sensitive (ESDS) Devices (2012)	JEDEC Solid State Technology Association, www.jedec.org
USA		
ANSI/ESD S20.20-2014	Protection of Electrical and Electronic Parts, Assemblies and Equipment (2014)	ANSI – American National Standards Institute, www.ansi.org
EUROPE		
DIN EN 61340-5-1: 2017-07	Electrostatics – Part 5-1: Protection of Electronic Components against Electrostatic Phenomena – General Requirements (2017)	German Institute for Standardization www.din.de/en
VDE 0300-5-1: 2017-07	(unchanged from IEC 61340-5-1)	VDE (Association of Electrical Engineering Electronics Information Technology), www.dke.de

IEC
All major standards are coordinated and communicated worldwide. Nowadays, the contents of international standards are usually disseminated by the IEC (International Electrotechnical Commission) headquartered in Geneva, Switzerland. The IEC standards are then translated into national standards and guidelines.

IPC
The IPC (Association Connecting Electronics Industries), the world's leading association, is the most important contributor to the IEC and is the only institution to provide a complete set of guidelines for the entire process chain to manufacture circuit board assemblies. The regulations are developed in cooperation with national and international companies as well as institutions.

JEDEC
JEDEC Solid State Technology Association is a US-based organisation that develops guidelines for the micro-electronics industry and for the standardisation of semiconductors.

“The industry committee which developed IPC-J-STD-001 standard provided the industry with a guideline for temperature and humidity in the manufacturing environment to verify that electrostatic discharge control is adequate.



A controlled and stable humidity is part of the environmental controls.”

Lars Wallin
IPC European Representative

IPC J-STD-001F: “When humidity decreases to a level of 30% or lower, the manufacturer shall verify that electrostatic discharge control is adequate, and that the range of humidity in the assembly area is sufficient to allow soldering and assembly materials to function correctly in the process, based on vendor recommendations or documented evidence of process performance.”

IEC 61340-5-2.2016: “Introducing humidity control within an ESD protected area is a method for reducing electrostatic fields to a permissible level.”

JEDEC JESD625B: “Relative humidity has an impact on the formation of electrostatic charges and can thus support an existing ESD protection programme.”

Climate control

- 1 The electrical sector is growing
- 2 Importance of semiconductors rises
- 3 ESD protection becoming more important
- 4 SMD components are getting smaller and smaller
- 5 Protect employees against air pollution
- 6 Humidifiers ensure quality



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ELECTROSTATICS

HUMIDIFIED AIR PROTECTS

Optimum humidity equals ESD protection

Protecting against uncontrolled electrostatic discharges is indispensable in the electronics industry. For electronic assemblies and sensitive semiconductors, even discharges as low as 30 volts can cause damage and hidden defects. Optimal humidity reduces the charging behaviour of materials and thus provides effective additional ESD protection.



Electrostatic charges are generated when static electricity is created between two surfaces, which are then separated. In the electronics industry, this can happen at just about any workplace – both between human and machine and within machinery. When two surfaces with different conductivity come into contact, electrons flow from one material to the other. As a result, the surfaces are charged either negatively or positively. For materials with excellent conductivity, a complete exchange of the charge takes place immediately after their separation. Poorly conductive or insulating materials, on the other hand, keep their new charge states, which can reach several thousands of volts when the distance is increased.

These materials pose a significant risk, as they can discharge uncontrolled at any time on at-risk components through direct contact or via the air.

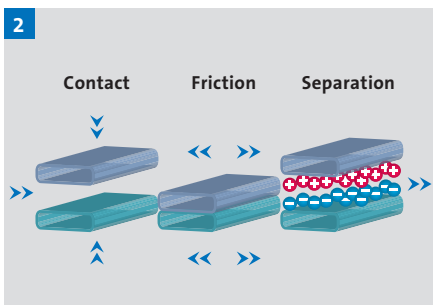
Undetectable faults

Uncontrolled discharges are caused both by human operators as well as devices and machinery, such as soldering tips, pick-and-place machines or packaging. Increasingly small and more powerful components can be damaged even by low voltages. And even more grave than the costs for identifiable total failures of semiconductors are undetectable faults that occur in spite of quality assurance, which can lead to consequential damage and a shortened lifespan of the final product. In such cases, year-round controlled humidity can provide additional security to any ESD protection programme.

No discharge without charge

For comprehensive ESD protection, electrostatic charges must be avoided whenever possible, and defined,

controlled discharging must be facilitated. For this, optimum air humidity comes with two benefits: At a relative humidity between 40 % and 60 %, a natural, conductive moisture film forms on the materials. This makes even surfaces and insulators with low conductivity more conductive. In the case of frictional contact with subsequent separation, this facilitates a complete charge exchange between the materials without creating any dangerous charges. It also increases the conductivity of the air, so that electrical charges can be dissipated into the atmosphere without causing damage to materials and machinery.



Activity	Relative humidity	
	10–25%	> 60%
Working at the table	6,000 volts	100 volts
Packaging paper in plastic wrapping	7,000 volts	600 volts
Walking over an artificial floor	12,000 volts	250 volts
Getting up from a chair with foam padding	18,000 volts	1,500 volts
Removing plastic packaging from printed circuit boards	26,000 volts	1,000 volts
Walking over carpet floor	35,000 volts	1,500 volts

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From assembling to painting

Minimising scrap and keeping subsequent work and repairs to a minimum are a must for the production department to remain competitive. In addition to the overriding importance of electrostatic protection, there are numerous processes and production steps which are positively impacted by optimal humidity in terms of quality, time and costs.

Dry air is quite common particularly in the winter months. The waste heat generated by the machinery is another contributing factor. A temperature increase of 1°C causes the relative humidity to drop by about 3%.

Pick-and-place machines

For SMD and THT printed circuit boards, error-free machine runs and precise assembly are decisive in terms of their performance. Optimal humidity has a positive impact on the placement accuracy and speed of the process: If the air is too dry, the components may electrostatically adhere to the cover foil of the blister strips and are then no longer accurately gripped by the pipette of the pick-and-place machine. Cardboard straps are subject to shrinking and dimensional changes. Even the slightest twisting and additional tensioning of the straps can have a negative effect on

the placement accuracy. This results in missing, offset or stray components, which can lead to feeder disturbances and line shutdowns.

Optimised soldering process

Soldering electronic assemblies also requires exacting process parameters in order to ensure a smooth production run with continuous wetting. Relative humidity influences the viscosity of the solder paste: The welding flux in the soldering paste evaporates if the humidity is too low. Limited flowability and too fast drying out of the soldering paste can result in uneven soldering processes and flawed soldering joints.

Dust suppression

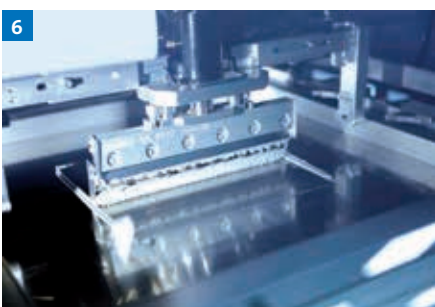
Higher air humidity cleans dust from the air and reduces deposits on machinery and components.



The thin film of water that surrounds the dust particles causes the dust to float in the air for a shorter period of time, fall to the ground quicker and keep it from getting kicked up again.

Gluing and painting

Gluing processes are common in the final assembly of components and in the assembly of circuit boards. Air that is too dry affects curing and reduces the strength of the glue. When a protective coating is applied to assemblies, increased humidity guarantees a smooth lacquering process and optimal application of the coating.



Quality assurance

- 1 Humidity is important for ESD protection
- 2 Electrostatics are caused by friction
- 3 Surfaces must be conductive
- 4 Humidity reduces charges
- 5 Placement errors due to dry air
- 6 Humidity affects the soldering process
- 7 Quality assurance is a must

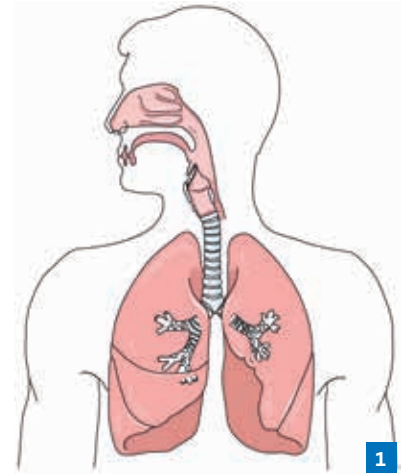
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HEALTH

MORE PRODUCTIVITY WITH OPTIMAL AIR HUMIDITY

People in focus

Well-being at the workplace is one of the most important prerequisites for having motivated and productive staff. This is in large part connected to the room climate and humidity, in particular: Air that is too dry is not only perceived as unpleasant, but also manifests in physical symptoms such as mucosal irritation, nose bleeds and eye problems.



Thermal comfort in the workplace plays an important role in the electronics industry in particular: long production lines, high machine densities, closed sterile- or cleanroom conditions and high output of waste heat from machinery often cause climatic stress. High temperatures above the recommended 20° and 22°C and the resulting humidity values of less than 30% have a negative effect on the contentment and performance of the employees. What ensues is a higher metabolism, burdened circulatory system and curtailed physical endurance. More ailments can be added to this list if the air is also dry, which adversely impacts the health of employees and results in their subsequent absence, in the worst case scenario.

Irritation of mucous membranes

The mucous membranes of the respira-

tory tract (nose, bronchial tubes, lungs) are sensitive to consistently dry air. If the protective mucus layer dries out or is reduced in thickness, dusts, micro-particles and allergens can penetrate unimpeded into the mucous membranes. Frequent symptoms are throat infections, hoarseness, coughing and feeling compelled to swallow. The vocal apparatus also suffers as a result of insufficiently moistened mucous membranes, which can lead to a loss of voice in severe cases. Nasal mucous membranes which are irritated by dry air frequently cause nose bleeding.

Degraded immune defence

Too dry air also affects the self-cleaning function of the mucous membranes and thus the immune system of human beings. With a relative humidity of less than 30%, the mucous membranes of the respiratory tract can no longer

transport disease-causing microorganisms from the body. Studies also show that if the humidity is too low, the risk of being contagious increases sharply due to the extended lifespan of viruses and their dwell time in the air.

Eye problems

Manually equipping components, manual soldering and optical and visual inspections are strenuous work for the eyes. If the air is too dry, the fluid of the tear film, which protects the conjunctiva from environmental effects, evaporates. In extreme cases the tear film can even rupture. Common symptoms are swollen eyelids, red eyes, burning of the eyes and inflammation. This results in decreased ability to concentrate and lowered performance. Staring at test tables and microscopes for hours at a time adds to the strain.



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Climate for wellbeing

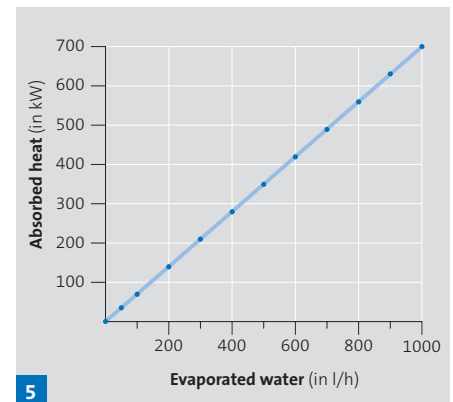
High temperatures in production are a burden on personnel, materials and machinery. On the other hand, the cooling of production rooms requires a lot of cooling capacity, resulting in high energy costs. Additional air humidification can reduce the costs for using air-conditioning systems many times over and increase the comfort for man and machine.

Temperature is an important process parameter for many manufacturing stages in the electronics industry. For soldering and bonding, the temperature of the processed materials may not exceed certain maximum values, for example. Too warm interior air also has a direct effect on humidity: With rising temperature, the relative humidity drops, entailing all the negative consequences for ESD protection (see fig. 6). As well, high temperatures are also a burden on the employees.

Evaporative cooling

Climate control in production facilities requires a lot of cooling capacity, resulting in high energy costs. When using additional air humidification, the deployment of a direct room humidifica-

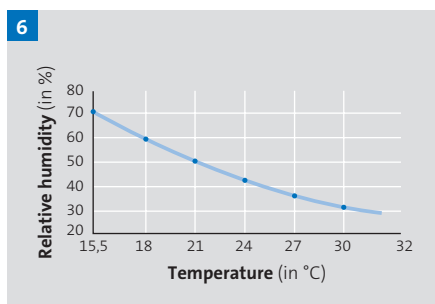
tion system can reduce the costs of air-conditioning a plant or simply reduce the room temperature independently of such a system. The reason is the adiabatic cooling effect that occurs when cold water is sprayed into the room air drip-free: The complete absorption of the micro-fine, atomised water droplets in the air causes heat to be drawn from the room. The principle of adiabatic evaporative cooling achieves an extremely cost-effective lowering of the room temperature. For example 100 liters of water from a high-pressure humidification system absorbs around 70 kW heat while consuming only 0.6 kW of energy, achieving a potential reduction in room temperature of between 2 °C and 5 °C.



5

A fresher room climate

An added benefit of direct room air humidification is the pleasant freshness of the indoor climate. The extremely fine, almost invisible atomisation of the water directly in the room ensures fast and drip-free moisture absorption in the air. The result is a pleasantly fresh room climate that revitalises, with beneficial effects on the skin, respiratory tract and the body as a whole. This relieves stress and increases the sense of well-being in the workplace. Additionally, high humidity cleans the air of dust particles and fine dust. Optimal humidity between 40% and 60% lets the dust particles fall to the ground quicker and thereby reduces the risk of inhalation.



6



7

Health and well-being

- 1 Humidity protects mucous membranes
- 2 Fewer airway infections
- 3 Maximum strain for eyes
- 4 High temperatures make work difficult
- 5 Humidification absorbs heat
- 6 Temperature and relative humidity
- 7 High-pressure nozzle humidifier

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HUMIDIFICATION TECHNOLOGY

AN OVERVIEW OF POTENTIAL SYSTEMS

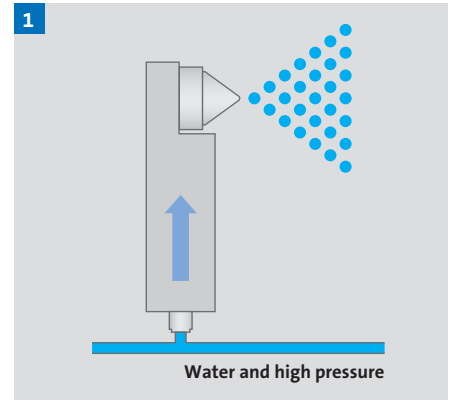
One goal, multiple options

Different systems and technologies are applied in the electronics industry to ensure adequate humidity: Which technology is used and whether direct or indirect humidification is applied depends on the structural conditions and the user requirements in terms of energy consumption, maintenance and humidification output.

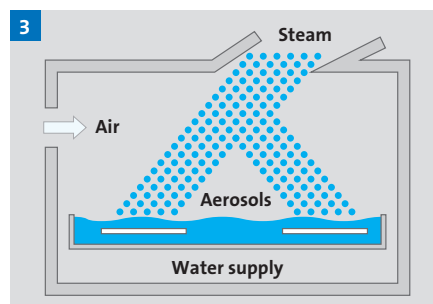
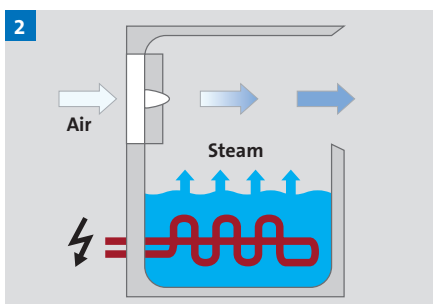
In general, we can distinguish between two basic principles in humidification: direct and indirect humidification. With a direct room air humidification system, separate humidification units are installed directly in the room, and also clearly visible. With indirect humidification, moisture is added to the air in the innards of a centralised air-conditioning system (HVAC/air conditioning) and fed into the working area by using a system of ducts and outlets. Both basic principles are used in the electronics industry: The simple and flexible installation of direct room air humidification makes this solution particularly attractive for retrofitting existing buildings.

Technologies

The technologies available today for use in direct room humidification systems vary in terms of their energy consumption, maintenance costs and humidification capacity: With **evaporators**, a fan is used to draw in room air, which is then passed over a moist wick. The humidification process takes place by evaporation on the surface of the contact body. While these kinds of humidifiers require very little electricity to run, humidification performance is also low, and there is a high risk of bacterial growth without thorough cleaning and inspection. **Steam-based humidifiers** produce steam in a temperature stable plastic or stainless steel cylinder, where humidifier water is heated to 100 °C. Steam humidifiers are hygienic, since microbes and bacteria are reliably killed



off by this process. For electrode and resistor based steam humidifiers, energy consumption is very high, and the service life of the steam cylinder is limited due to lime scale. With **humidifiers**, water is broken into a spray of tiny water droplets. A fan then propels the aerosols so generated into the room air, where they are absorbed immediately. Humidifiers are available with ultrasonic oscillators and compressed air or high-pressure nozzles. Humidifiers can humidify large interior spaces while consuming very little energy. Humidifiers typically require a water treatment plant capable of producing sterile, demineralised water.



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HUMIDIFICATION TECHNOLOGY

AN OVERVIEW OF POTENTIAL SYSTEMS

High pressure air humidification

In recent years, many companies have replaced steam and compressed-air humidifiers with high-pressure nozzle systems. These systems use a high-pressure pump and special nozzles to atomise the water into a fine mist directly in the room as part of a virtually silent process. Energy consumption is also only a fraction of typical values for nozzles powered by compressed air or steam humidifiers. The adiabatic cooling effect of cold water evaporation also creates a pleasant indoor climate. This adiabatic cooling effect can positively support the use of an air-conditioning system. For each kilogram of water that evaporates per hour in the air as a result of nozzle humidification, a cooling capacity of 700 W can be achieved. To ensure hygienic and trouble-free operation, only ultrapure, demineralised water is used – provided by a reverse osmosis plant that is integrated into the humidification system.

Direct or indirect?

However, there is no blanket answer to the general question of whether the required humidity level can be better provided indirectly through the ventilation and air conditioning system or through a direct room air humidification system. Depending on the local conditions and the requirements of building users, a combination of indirect and direct humidification may also make sense, with the indirect humidification system providing basic humidification, and direct air humidification providing additional spot humidification in defined areas. The advantage of direct room humidification is basically in its targeted and individual management of moisture. Production areas used for different kinds of work and with different humidification requirements – such as SMD assembly, module assembly – can be humidified precisely according to demand. For specialised machinery and applications, targeted “hot spots” for areas or materials can also be implemented, to ensure higher levels of humidification as needed.



Ideal for retrofitting

The question of whether humidification should be indirect or direct is of course always also a question of structural conditions. In many older production halls, the implementation of an indirect humidification system can be achieved only with a very high structural and financial investment, because the air-conditioning ducts are either not present or inadequately sized. For a retrofit, direct room air humidification is therefore the simpler and much more affordable solution for most applications in the electronics industry. Even the necessary maintenance can be implemented with less effort due to improved accessibility to the humidifiers and the water-carrying systems.



Humidification technology

- 1 High-pressure nozzle humidifiers
- 2 Steam humidifiers
- 3 Ultrasonic humidifiers
- 4 High pressure system for ceiling mounting
- 5 Direct room air humidification
- 6 Energy-efficient: High-pressure nozzle systems
- 7 Targeted spot or material moistening

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DIRECT ROOM AIR HUMIDIFICATION

STATE OF THE ART

Into the air with high-pressure

Direct room air humidification with high-pressure technology is today regarded as the state of the art for many industrial applications. Ease of installation, safe control, low energy costs and good maintenance access are some of the characteristics that make the case for using high-pressure humidification directly in the room also in the electronics industry.

With direct room air humidification, the humidifiers are installed directly in the production hall or in the room to be humidified instead of centrally in the air-conditioning system (HVAC). Attached to the wall or ceiling, the units spray a micro-fine “mist” as required, which is immediately absorbed into the air and distributed evenly through the room. The microfine atomisation with a droplet size of less than 15 µm is achieved by the high-pressure technique that pushes the water through the high-performance nozzles at an operating pressure of 85 bar (1232 psi). The energy consumption of the high-pressure pump compared to steam or compressed-air systems is very low with 700 W.

Simple installation

By separating the ventilation and air-conditioning from the water atomi-

sation, the systems can be installed independently of an air conditioner with little structural effort. Specialised, only finger-thick high-pressure hoses and the necessary power and control cables provide the connection between central water treatment and the decentralised humidifiers. The simple and adaptable installation makes direct room air humidification particularly interesting for retrofitting.

The right water

The water treatment is also important for the quality and hygiene of air humidification. Untreated water is not suitable for air humidification. This is because of the large number of substances in water: Bacteria, germs, suspended particles, salts and other minerals can pose a serious threat to human health and the functioning of machines and components. Particularly



in the electronics industry, the water must be treated in such a way that no additional dust enters the production rooms. This requires multi-stage water treatment, which first cleans the water, disinfects it and completely removes all minerals.

Straight to the point

The required relative humidity is controlled via digital control systems which permanently monitor the climatic situation in the rooms and ensure a constant humidity level. The humidifiers are actuated with pinpoint accuracy as soon as the setpoint is fallen short of. As individually defined humidification zones (halls or partial areas) are specified for direct room air humidification, it is possible to use different setpoints for rooms that are used for different purposes.



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DIRECT ROOM AIR HUMIDIFICATION

HYGIENE AND MAINTENANCE

Maintenance – but safely!

Air humidification systems are only as good as their underlying service and maintenance concept. Even if the water used appears clean and clear, substances in the water can still pose risks to the employees' health and to operational safety. Hygienic standards and systems with automated maintenance intervals reliably eliminate all risks.

Typically, a reverse osmosis plant is used for the hygienic treatment of the water to be used in humidification systems. Despite optimal pre-treatment of mains water with softener and filtration stages, undesirable deposits can still form on reverse osmosis membranes and other key components within a humidification system. These are not only capable of seriously compromising the performance and service life of the plant, but also – and above all – present a serious risk to human health. Routine inspections, maintenance, disinfection and the replacement of heavily worn system components are therefore absolutely essential for the safe and hygienic operation of the humidification system.

Maintenance is a must

In order to prevent contamination of water-bearing elements and to prevent the uncontrolled propagation of microorganisms, comprehensive hygiene measures are necessary to comply with microbiological limits. As a rule, pumps, reverse osmosis membranes, UV-C lamps and other critical components should be serviced every six months. If the upper limits of germ contamination are exceeded, the inspection intervals must be halved until it can be permanently ascertained that the air humidification systems are in a safe state.

Microbiological limit values of the humidifier water according to the current state of the art

1) Legionella	<100 CFU / 100 ml
2) Total colony count	<150 CFU / 100 ml

CFU = Colony-forming unit, variable for quantification of microorganisms



Compliance with standards and certificates

Modular systems that are replaced in fixed time intervals and sent to the manufacturer for maintenance are advantageous. With these automated maintenance programmes, users do not have to worry about hygienic measures and can rest assured that they are always operating a functionally safe and hygienic air humidification system. Details of the hygiene standards of the various humidification systems can be obtained from national and international certificates issued by independent testing labs, and from manufacturers' maintenance and service programmes.



High pressure, hygiene and maintenance

- 1 Constant humidity in production
- 2 Easy to retrofit in any hall
- 3 Digital control
- 4 Multistage water treatment
- 5 Microbes and bacteria must be avoided
- 6 Routine maintenance
- 7 Maintenance of mobile systems at the manufacturer

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CASE STUDY

ASTEELFLASH HERSFELD GMBH, BAD HERSFELD

Air humidification with twice the benefits

The Asteelflash Group is a multinational service provider for electronic manufacturing and offers the complete manufacture of integrated electronic systems. Headquartered in France, the group of companies employs over 5,000 people worldwide. At their site in Bad Hersfeld, controlled humidity not only optimises the production processes, but also improves the working conditions of the employees and protects their health.

Since their founding in Paris in 1999, Asteelflash has enjoyed significant growth and has become one of the top 20 EMS providers worldwide. With a total production area of around 160,000 m², the company now consists of 18 centres of excellence, which are strategically distributed over four continents. The extensive range of services provided includes PCB assembly through complete system solutions pursuant to individual manufacturing specifications to recycling logistics for customers. The market segments serviced include above all the energy industry, data processing and transport in addition to general industries. At the largest German facility in Bad Hersfeld, the company produces integrated electronics systems and modules for the automotive industry, among other things.

Motivated and healthy employees

One of the defined goals of the group is to continuously improve their quality and competitiveness. For Felix Timmermann, General Manager EEMEA Region at Asteelflash, standardised processes, sector-specific quality management systems, top ESD security and comprehensive testing and verification facilities are equally important as having a controlled room climate: "We want to offer our customers the best possible conditions for production. Controlling the temperature and humidity is very important for ESD protection, the assembly process, gluing and painting processes and electrical tests." The firm conviction that the quality of services rendered is above all founded upon the know-how and skills of the employees was another reason for retrofitting



with air humidification in Bad Hersfeld: "Just as important as controlling the technical aspects of the production processes is the creation of an optimal working environment in which our employees are motivated and healthy. Having adequate humidity is also a key factor", Felix Timmermann adds.

Impressive overall concept

A direct room air humidification system has been providing standardised humidity in the ESD-protected production areas since 2016. Over 40 high-pressure DRAABE TurboFogNeo humidifiers guarantee optimum relative humidity of 45% year-round. For installation, Asteelflash merely required a mains water system and drain, plus an appropriate electricity supply. Everything is supplied to the



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building from a central mechanical room, where both the water treatment systems and the high-pressure pump are installed. These systems are connected to the humidifiers using specialised high-pressure hoses and control lines. Attached to the wall or ceiling, the small air humidifiers spray a micro-fine “mist” with a droplet size below 15 µm as required, which is immediately absorbed into the air and distributed evenly through the room. The required humidity is regulated using a digital control system. In each of the individually defined humidification zones of the halls, control units measure the current level of humidity and activate the humidifiers when it falls below the set target value. Dominik Baumbach from facility management was convinced by the overall concept from the outset: “The individually positionable humidifiers ensure good distribution of the humidity in the room and meet all hygienic requirements in combination with the professional water treatment.”

Fewer production interruptions

Shortly after installation, the controlled humidity already had a positive impact on the pick-and-place machine: “Primarily with very small

SMD components of the 0402 design, we have less scrap and fewer stray components”, Shift Director Jens Bick confirms. Optimal air humidity prevents electrostatic charging of the rotating blister straps and provides additional security in terms of preventive protection against early failures in the field. For other processes in the production chain, such as lacquering, controlled humidity is an important quality assurance parameter. Electrical tests and functional tests can also be carried out with utmost precision since the constant ambient humidity ensures a uniform current flow.

Thrilled staff

The climate has also improved significantly for the employees: “The air is much fresher than before, which is most noticeable in the throat and nose. And in the summer the humidification also has a cooling effect”, line manager Cristian Ionita describes the positive feedback of his colleagues. Optimal humidity keeps the respiratory mucous membranes from drying out and thus protects against nose bleeds, burning eyes and infections of the airways. For Felix Timmermann, it is clear that the humidification system has more than just one benefit: “The

Fact File

Humidification:	44 high-pressure fogging units
Rooms:	total 3,000 m ²
Required humidity:	45% rel. humidity
Start-up:	2016

system is important for optimising our processes, but at the same time it also has a very positive impact on the well-being and health of our employees.”



Asteelflash Hersfeld GmbH

- 1 Felix Timmermann sees two benefits
- 2 Controlled humidity at Asteelflash
- 3 DRAABE TurboFogNeo
- 4 Air humidification in ESD protected area
- 5 Optimal in-line assembly with small components
- 6 Healthy indoor climate for employees

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CASE STUDY

ZOLLNER ELEKTRONIK AG, ZANDT/VÁC

Everything flows smoothly

Zollner Elektronik AG is one of the world's leading companies in the field of Electronic Manufacturing Services (EMS). Controlled humidity is an integral part of ESD protection at Zollner. Over 300 direct room humidifiers are used in Germany and Hungary for quality assurance.

Zollner AG employs more than 8,000 staff worldwide at 18 locations in Europe, the USA, Asia and North Africa. About half of the employees work in the two largest plants in Zandt (Germany) and Vác (Hungary) and offer a broad range of services ranging from electronic assemblies through modules to complete systems. The success story began in 1965 with the one-man operation of the company founder Manfred Zollner. Now, the company group offers complex mechanical systems from development to after-sales service for prestigious customers. "Having a technological edge and a best-cost-country strategy along the entire value chain are a matter of course for us", explains Bernhard Kirst, Head of Marketing at Zollner. The requirements of the customer alone determine the process depth provided by Zollner. Quality assurance is an important aspect in every project.

ESD protection

A direct room air humidification system has been part of the Zandt main ESD protection programme since 2009. Over 200 high-pressure humidifiers DRAABE TurboFogNeo are used at the location and ensure that electrical charges can be dissipated without uncontrolled discharges and the ensuing damage. Zollner manufactures in a relative humidity range between 30 and 70% pursuant to the international standard J-STD001. Parts of the 300,000 m² production area were equipped with the DRAABE air humidification system in several phases of construction.

Reliable and accurate

Since 2015, the automotive production area in Vác, Hungary is also enjoying DRAABE air humidification. "We knew from our German colleagues how reliable these systems are, and we were very



happy about the decision", explains Géza Cser, Head of Building Technology in Vác. In selecting its humidification system, the individual configuration and controllability of the system were particularly important to Zollner. The necessary humidity levels can be individually adjusted for the various production halls in order to establish consistent conditions for ESD protection and the soldering processes. "We know we can rely on this technology, and we were very excited about the precise DRAABE measuring and control technology from the start", Jürgen Janda, Facility Management Head of Building and Construction at Zollner (until 2015) remembers.



When water protects

Cleaning the air

In addition to protecting against electrostatic discharges, the additional air humidification at Zollner also protects against contaminants in the air. Processing functionally relevant components and systems requires taking into account environmental contaminants. If macroparticles are floating in the air, the cleanliness requirements cannot be met and this can lead to a functional failure of the product. Particularly in applications such as electromobility and high current technology, precise compliance with air and creepage distances is critical. Sufficiently high atmospheric humidity binds air particles, allows them to fall to the ground faster and keeps them from depositing and being kicked up again in the production halls. In order to comply with the cleanliness requirements, particularly in the electronics industry it is important that no additional dust is carried into the working areas due to the air humidification. To meet these requirements, Zollner uses multistage DRAABE water treatment for air humidification.

Water and maintenance

Water treatment begins with water softening. Here, the calcium and magnesium salts are replaced with readily soluble sodium salts. In the next phase,

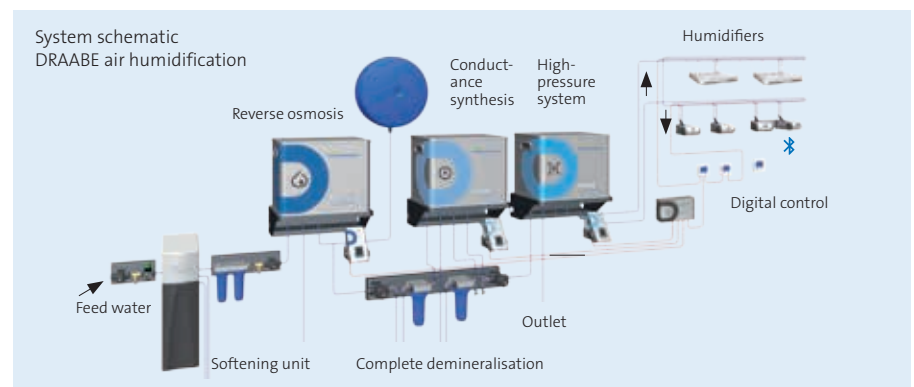
the water is purified by being passed through a two-step mechanical filter. At the heart of water treatment is reverse osmosis: The pretreated water is almost completely desalted and sterilised by the membrane separation technique. An additional conductance synthesis completely removes all residual minerals dissolved in the feed water and thus ensures that no additional dust enters into the room. Reverse osmosis, the conductance synthesis and the high-pressure pump are installed in small mobile containers, which enables comprehensive maintenance and disinfection of the plants by simple replacement of the complete system. This standard service is performed by the manufacturer automatically at half-yearly intervals. This maintenance concept is a big plus for Géza Cser: “The automatic replacement ensures that the plant is always functional and

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Fact File

Humidification:	326 high-pressure fogging units
Rooms:	total 30,000 m ²
Required humidity:	30% – 70% rel. humidity
Commissioning:	since 2009 in several phases

hygienic. We don't have to worry about maintenance, and everything works without a hitch.”



Zollner Elektronik AG

- 1 For Géza Cser, everything works smoothly
- 2 Main Zollner plant in Zandt
- 3 Air humidification for automotive sector
- 4 More than 300 humidifiers in use
- 5 Multilevel DRAABE water treatment
- 6 Controlled humidity means ESD protection

When water protects

WHEN WATER PROTECTS



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