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YEARS

klimaoprema

info

Časopis za promicanje novih tehnologija, materijala i proizvoda na području klimatizacije, ventilacije i čistih prostora.

A magazine to promote new technologies, materials and products in the field of air conditioning, ventilation and cleanroom.

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KLIMAOPREMA 45TH ANNIVERSARY

45. GODIŠNJICA KLIMAOPREME

New cleanroom projects • New products: SCU-UV and Heat recovery unit • Digital transformation: Autodesk collaboration, panel production software • Diagnosis of HVAC system malfunction

Novi cleanroom projekti • Novi proizvodi: SCU-UV i Rekuperator • Digitalna transformacija: Autodesk kolaboracija, program za proizvodnju panela • Dijagnoza kvara u radu HVAC sustava

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A WORD FROM EDITOR

RIJEČ UREDNIKA

Matija Sviben

Marketing manager

Dear friends and business partners,

First and foremost, it is a great honor and pleasure to work on a magazine with a long-standing tradition and I believe that you will find many interesting and inspiring topics in this issue as well.

We begin this issue of the magazine with an overview of the timeline of Klimaoprema on the occasion of its 45th corporate anniversary.

When it comes to cleanrooms, we are extremely proud to have the opportunity to work on one of the most relevant projects in the history of the company – namely, we have undertaken the production of vaccines for the COVID-19 virus.

As in every issue so far, our research and development department brings you new products in the areas of cleanrooms, ventilation and electronic solutions. Read more about our SCU-UV system for disinfection of ventilation ducts, recuperators; heat recovery unit, as well as an introduction to the novelties of our electronics department.

As we continuously invest in the digital transformation of the company and as satisfied users of Autodesk software tools, we have opted for implementing Vault - Autodesk's solution for a centralized database of all our projects and products.

Our robotics department also implements software solutions for digitization and automation of the panel production plant for cleanrooms, which will speed up the preparation process and markedly minimize the number of errors in the process.

Digitization of the company; more precisely the introduction of the BIM system, also assisted the validation department in their process

of servicing and maintaining ventilation ducts in cleanrooms.

This year has certainly brought about new challenges to be adapted to. In the article by our colleague Doria Štibić you can read how our sales department coped with the new economic situation.

In the interview with Tamara Aleksandrov, you can learn all about the experiences of working and using a laminar protection device for the requirements of the Department of Metallurgy at the Faculty of Mechanical Engineering and Naval Architecture in Zagreb.

Along with exponential growth of the company and the number of employees, the need for a larger and stronger human resources department is unquestionable. In the article by our colleague Nataša you can find out about the development and future of our internal departments.

And at the very end of the magazine you can read other news about our company, industry, production, fairs and our latest references.

Dragi prijatelji i poslovni partneri,

Za početak, velika mi je čast i zadovoljstvo raditi na časopisu s ovolikom tradicijom i vjerujem kako ćete i u ovom broju pronaći mnogobrojne zanimljive i inspirativne teme.

Ovaj broj časopisa započinjemo pogledom na vremensku crtu Klimaopreme povodom proslave 45. godišnjice osnivanja tvrtke.

Kad su čisti prostori u pitanju, iznimno smo ponosni što imamo priliku raditi na jednom od najbitnijih projekata u povijesti tvrtke – izvodimo projekt za proizvodnju cjepiva protiv virusa COVID-19.

Kao i u svakom broju dosad, naš odjel za istraživanje i razvoj donosi vam nove proizvode na području čistih prostora, ventilacije i elektroničkih rješenja. Pročitajte više o našem SCU-UV sustavu za dezinfekciju ventilacijskih kanala, rekuperatora (uređaja za povrat topline) te o novitetima našeg odjela za elektroniku.

Budući da neprekidno ulažemo u digitalnu transformaciju tvrtke te smo zadovoljni korisnici Autodeskovih programskih alata, odlučili smo se za primjenu Vaulta koji predstavlja Autodeskovo rješenje za centraliziranu bazu podataka svih naših projekata i proizvoda.

Naš odjel za robotiku također primjenjuje programska rješenja za digitalizaciju i automatizaciju proizvodnog pogona panela za čiste prostore, što će ubrzati tijek pripreme te smanjiti broj grešaka u postupku.

Digitalizacija tvrtke, točnije, uvođenje BIM sustava, također je pomogla odjelu validacije tijekom servisiranja i održavanja ventilacijskih kanala u čistim prostorima.

Ova je godina svakako donijela nove izazove kojima se moramo prilagoditi. U prilogu kolegice Doria Štibić možete pročitati kako se naš odjel prodaje snašao u novonastaloj gospodarskoj situaciji.

U intervjuu s Tamarom Aleksandrov možete saznati sve o iskustvima rada i korištenju laminarnog zaštitnog uređaja za potrebe odjela metalurgije na Fakultetu strojarstva i brodogradnje u Zagrebu.

Uz veliki rast tvrtke i broja zaposlenih, neupitna je potreba za većim i snažnijim odjelom ljudskih potencijala. U članku kolegice Nataše Batur možete pročitati sve o razvoju i budućnosti poslovanja naših internih odjela.

Na samom kraju časopisa možete pročitati preostale novosti o našoj tvrtki, industriji, proizvodnji, sajmovima te našim najnovijim referencama.

KLIMAOPREMA – YESTERDAY, TODAY, TOMORROW

KLIMAOPREMA – JUČER, DANAS, SUTRA

Sergio Galošić

CEO

For more than four decades, Klimaoprema has been enriching society, enhancing the quality of life, and having a positive impact on the environment and the technological standards of the industry. It is owing to a number of generations that Klimaoprema today stands as a stable production and technology company that represents a significant player on the European scene, raising the bar higher with its quality and reliability in standards.

How our plants grew

In 1975, in the rented space of a private house, numbering 12 employees, the production of ventilation grilles was started for the needs of the local market. The business expanded and in 1981 a 600 m² production plant was opened in Samobor.

Since 2005, there has been a cycle of investments in the production park, facilities and human resources. In the town of Gradna, near Samobor, a business-production plant was constructed, which today stands as the company's headquarters. From the original 4.500 m², the plant has been extended with an additional building and a high-bay warehouse, to the total area of 13.000 m².

In 2015 heavy investments continued with the construction of a production and storage facility in Nova Gradiška, which today covers an area of 30.000 m².

The enlargement of the plant was accompanied by significant investments in machinery, today highly robotic and automated production facilities designed and developed in cooperation with renowned European manufacturers of CNC

machines and in synergy with the greatest experts of the Faculty of Mechanical Engineering and Naval Architecture in Zagreb.

How our activities grew

Keeping up with market needs, development of new products and technological advances have enabled us to enter the global market and gain recognition in the world of ventilation, air conditioning and cleanrooms.

Today, Klimaoprema operates worldwide, and has established offices in Russia, the United Arab Emirates and countries in the region, Hungary, Slovenia, Macedonia, Bosnia and Herzegovina, and Serbia. Exponential expansion into Western European markets has not only boosted promotion of the company and the state, but also the contribution to the society and community in which we live. Klimaoprema has recently carried out a project in Switzerland, the first of its kind in the world, a cleanroom facility to be used for the treatment of acute pediatric lymphoblastic leukemia in children.

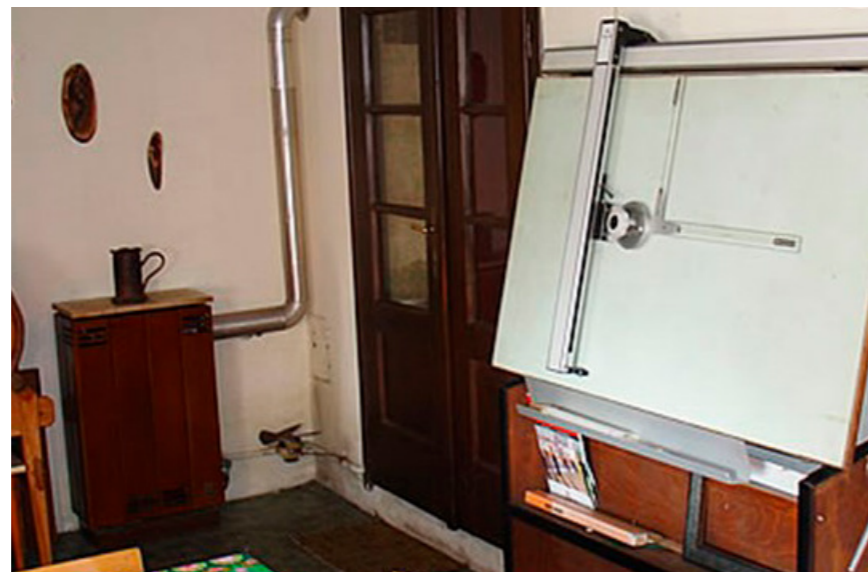
This type of leukemia accounts for 80% of all leukemia and 30% of all malignancies in children. In laboratory and hospital premises, a special method of stem cell treatment takes place, with a success rate of 83%.

It is this project we single out, among many activities that are worth mentioning, because such activities are our driving force, that give us a sense of contribution and fulfillment, as in doing so we impact the well-being and health of the community as well.

Klimaoprema today

Klimaoprema at this point employs 500 workers and manages human resources with a structured and well-designed strategy.

We have introduced 6S and Lean management into systematically organized production and improved organization and efficiency in the workplace. We are preparing a strategy for digital transformation, as introduction of Klimaoprema to Industry 4.0. We maintain an integrated risk record system. By continuously improving business



The first Klimaoprema office from 1975
Prvi ured Klimaopreme iz 1975. godine



Opening of new production space in Nova Gradiška in 2015
Otvaranje novog proizvodnog pogona u Novoj Gradišci 2015. godine

Više od četiri desetljeća Klimaoprema obogaćuje društvo, podiže kvalitetu života te pozitivno utječe na okolinu i tehnološke standarde industrije. Zahvaljujući nizu generacija, Klimaoprema je danas stabilna proizvodno-tehnološka tvrtka koja je značajan igrač na europskoj sceni te svojom kvalitetom i pouzdanosti nameće standarde na tržištu.

Kako su rasla naša postrojenja

1975. godine u unajmljenom prostoru privatne kuće, s dvanaest zaposlenih djelatnika, za lokalne potrebe tržišta pokrenuta je proizvodnja ventilacijskih rešetaka. Poslovanje se širilo te je 1981. godine u Samoboru otvoren proizvodni pogon veličine 600 m².

Od 2005. godine nastupa ciklus investicija u proizvodni park, objekte te ljudske potencijale. U Gradni pokraj Samobora izgrađen je poslovno-proizvodni pogon koji je danas sjedište tvrtke. Od prvotnih 4.500 m², postrojenje je prošireno dodatnom zgradom te visokoregalmnim skladištem do 13.000 m².

2015. godine ciklus investicija nastavlja se izgradnjom proizvodno-skladišnog pogona u Novoj Gradiški, koji danas obuhvaća 30.000 m².

Širenje postrojenja pratile su značajne investicije u strojni park koji

danas čine visoko robotizirani i automatizirani proizvodni pogoni, osmišljeni i razvijeni u suradnji s renomiranim europskim proizvođačima CNC strojeva te sinergijom s najvećim stručnjacima Fakulteta strojarstva i brodogradnje u Zagrebu.

Kako su rasle naše aktivnosti

Praćenje potreba tržišta, razvoj novih proizvoda te tehnološki napredak omogućili su izlazak na svjetsko tržište te stvaranje znatnog imena u svijetu ventilacije, klimatizacije i čistih prostora.

Klimaoprema danas posluje diljem svijeta, a vlastiti uredi otvoreni su u Rusiji, Ujedinjenim Arapskim Emiratima te zemljama u regiji: Mađarskoj, Sloveniji, Makedoniji, Bosni i Hercegovini te Srbiji.

Velika ekspanzija na zapadnoeu-

ropska tržišta nije utjecala samo na promociju tvrtke i države, već i na doprinos društvu i zajednici u kojoj živimo. Nedavno je Klimaoprema izvela projekt u Švicarskoj, prvi u svijetu, cleanroom postrojenje koje će se koristiti u svrhu liječenja akutne pedijatrijske limfoblastične leukemije kod djece. Ova vrsta leukemije čini 80% svih leukemija te 30% svih malignih oboljenja kod djece. U laboratorijskim i bolničkim prostorima odvija se posebna metoda liječenja matičnim stanicama, s 83% uspjeha.

Od mnogobrojnih aktivnosti koje je važno spomenuti, izdvojili smo ovaj projekt jer su ovakve aktivnosti naš motiv, ono što nas tjera naprijed, što daje osjećaj doprinosa i ispunjenosti, iza kulisa utječući na dobrobit i zdravlje zajednice.

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Anniversary logo redesign
Redizajn logotipa povodom godišnjice



Old building in the Samobor industrial zone built in 1981
Stara zgrada u samoborskoj industrijskoj zoni iz 1981. godine

processes, deploying modern world methodologies, we keep pace with the technological development of the industry in general. On top of that, we are consistently working on the optimization of production and the development of new products customized to market needs, of high quality standards, with all the necessary certificates. By means of high quality products for ventilation, air conditioning and cleanrooms, we meet the growing demands of energy efficiency and sustainability. We care about the environment we live and work in, our people and the community.

We cooperate with universities and scientific institutions, motivate students and contribute to the entire society.

Klimaoprema tomorrow

The combination of innovation, new technologies and experience has secured our position as a technological leader in the region. But this is not where we stop. The path to a global leader is not easy, it takes a great deal of knowledge, cooperation, patience and effort, and there is no end to it, there is always further to go. Klimaoprema moves forward, in the modern world, and other than embracing

new technologies, we also develop them. We are a future-oriented company, where employees are satisfied, where our work contributes and affects the well-being of the environment and people's lives. Heading for... the next 45 years.



Production and office space in Gradna, Samobor from 2005
Proizvodno-uredski prostor u Gradni, Samobor iz 2005. godine



Expansion of the production plant in Nova Gradiška
Proširenje proizvodnog pogona u Novoj Gradišci

Klimaoprema danas

Klimaoprema danas zapošljava petsto djelatnika te strukturiranim i osmišljenom strategijom upravlja ljudskim resursima. U sustavno organiziranu proizvodnju uveli smo 6S i Lean management te poboljšali organizaciju i učinkovitost na radnim mjestima. Pripremamo strategiju za digitalnu transformaciju koja predstavlja uvod Klimaopreme u Industriju 4.0. Vodimo integrirani sustav evidencije rizika. Stalnim unaprjeđenjem poslovnih procesa, koristeći suvremene svjetske metodologije, ostajemo ukorak s tehnološkim razvojem industrije.

Kontinuirano radimo na optimizaciji proizvodnje te razvoju novih proizvoda prilagođenih potrebama tržišta, visokih standarda kvalitete, sa svim potrebnim certifikatima. Uz visoko kvalitetne proizvode za ventilaciju, klimatizaciju i čiste prostore, zadovoljavamo rastuće zahtjeve energetske učinkovitosti i održivosti. Brinemo se za okoliš i okruženje u kojem živimo i radimo, za naše ljudstvo te zajednicu. Surađujemo sa sveučilištima i znanstvenim institucijama, motiviramo studente te zajedničkim snagama doprinosimo cjelokupnom društvu.

Klimaoprema sutra

Spoj inovativnosti, novih tehnologija i iskustva, osigurao je našu poziciju tehnološkog lidera u regiji. No, ne zaustavljamo se. Put ka globalnom lideru nije lagan, potrebno je veliko znanje, suradnja, strpljenje i napor, dok cilja nema, uvijek se može ići dalje. Klimaoprema ide dalje; u modernom svijetu prihvaćamo i razvijamo nove tehnologije. Tvrtka smo usmjerena budućnosti, u kojoj su djelatnici zadovoljni, a naš rad doprinosi te utječe na dobrobit okoline i živote ljudi. Krupnim koracima idemo dalje... U novih 45 godina.



Entrance to the production plant in Nova Gradiška
Ulaz u proizvodni pogon u Novoj Gradišci

VACCINE PRODUCTION LINE IN RESPONSE TO THE COVID-19 PANDEMIC

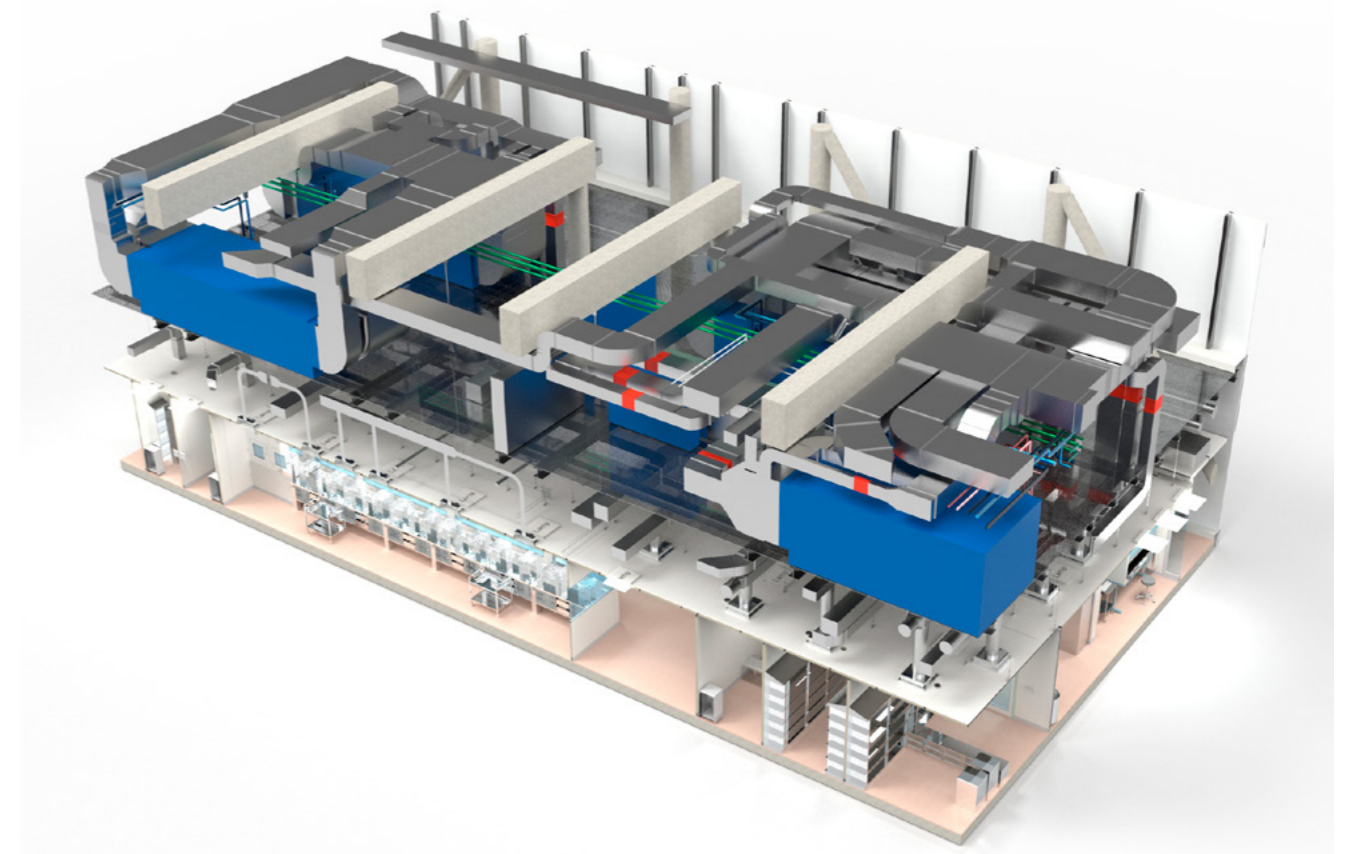
POGON ZA PROIZVODNJU CJEPIVA KAO ODGOVOR NA PANDEMIJU COVID-19

Marin Martinaga
Head of Cleanroom

Moderna, the U.S. company that has gone the furthest with the discovery and testing of the mRNA-1273 vaccine in response to COVID-19 decided to join forces with the Swiss company LONZA to prepare for the production of the vaccine in large quantities. Moderna has successfully completed the first phase of clinical trials, and the second phase, which is being conducted on 600 patients older than the age of 18, is nearing completion. The third and final phase of testing, which is going to be conducted on 30,000 patients, is about to begin in July. If this phase of clinical trials proves successful, and based on the results of the first two phases the likelihood of success of the third phase is expected to be high, Moderna will receive a license for the commercial production of mRNA-

1273. The vaccine will be produced at two LONZA sites. One is in the US, in Portsmouth, and the other in Switzerland in Visp. Klimaoprema has been selected as the main designer and contractor for the production plant in Switzerland. In this undertaking, as our subcontractor in design, we are accompanied by a renowned company for the development of the production process, CRB from the USA. Klimaoprema will be responsible for the complete project from the preliminary design phase to the completion of validation and hand-over to the user. The new production facility in Switzerland is located in Lonza's Ibex Complex in Visp. Ibex is composed of a cutting edge facility and a highly flexible business model resulting in fast project realization and production start-up while maintaining high flexibility for customer needs. The availability of a technology agnostic core & shell with central supplies, logistics and central infrastructure in place pa-

ired with an experienced Engineering and Operations team allows for fast track implementation of complex GMP production modules. The production space, which includes approximately 2.500 m², class CNC to C, needs to be designed and executed in a record time of 6 months from idea to initial production. This fast pace will enable the first vaccines for the market to be available as early as the beginning of 2021, which is crucial in these moments of uncertain future and problems on the global level. I believe that it is clear to everyone how important this project is for LONZA, and consequently how much trust LONZA has placed in Klimaoprema to handle the entire project management. The successful completion of this project, which will require immense efforts from all of us, can position Klimaoprema at the very top of engineering houses in Europe and mark the beginning of a very beautiful and long-standing story.



Moderna, tvrtka iz SAD-a koja je otišla najdalje s otkrivanjem i testiranjem cjepiva mRNA-1273, kao odgovor na COVID-19, odlučila je udružiti snage sa švicarskom tvrtkom LONZA kako bi se pripremila za proizvodnju cjepiva u velikim količinama. Moderna je uspješno završila prvu fazu kliničkih ispitivanja te je pri kraju druge faze koja se provodi na šesto pacijenata starijih od osamnaest godina. Tijekom srpnja započela je treća i posljednja faza testiranja koje se provodi na 30.000 pacijenata. Ako se i ta faza kliničkih ispitivanja pokaže uspješnom, a na temelju rezultata prve dvije faze govore da je vjerojatnost uspješnosti treće faze jako visok, Moderna će dobiti dozvolu za komercijalnu proizvodnju cjepiva mRNA-1273. Cjepivo će se proizvoditi na dvije lokacije LONZA-e. Jedna je u SAD-u, u gradu Portsmouthu, a druga u

Švicarskoj, u gradu Vispu. Klimaoprema je odabrana kao glavni projektant i izvođač za proizvodni pogon u Švicarskoj. U ovom poslu, kao proizvođače u projektiranju, prati nas renomirana tvrtka za razvoj proizvodnog procesa, CRB iz SAD-a. Klimaoprema će biti odgovorna od faze idejnog projekta do završetka validacije i primopredaje korisniku. Novi proizvodni pogon u Švicarskoj nalazi se u Lonzinom kompleksu Ibex u Vispu. Ibex se sastoji od vrhunskog pogona i izuzetno fleksibilnog poslovnog modela što rezultira brзом realizacijom projekata i pokretanjem proizvodnje, a istovremeno zadržava visoku fleksibilnost za potrebe kupaca. Dostupnost tehnološke agnostičke jezgre i ljuske sa središnjim zalihama, logistikom i centralnom infrastrukturom uparenim s iskusnim inženjerskim i operativnim

timom omogućuje brzu primjenu složenih GMP proizvodnih modula. Proizvodni prostor, koji uključuje okvirno 2.500 m², klasa CNC do C, potrebno je dizajnirati i izvesti u rekordnih 6 mjeseci; od ideje do prve proizvodnje. Ova brzina omogućit će da prva cjepiva za tržište budu dostupna već početkom 2021. godine, što je u ovim trenucima nesigurne budućnosti i problematike na svjetskoj razini presudno. Vjerujem da je svima jasno koliko je ovaj projekt važan za LONZA-u te, prepuštanjem cjelokupnog vođenja projekta, koliko povjerenje LONZA ima u Klimaopremu. Uspješni završetak ovog projekta, koji će zahtijevati ogromne napore, može pozicionirati Klimaopremu u sam vrh inženjering kuća u Europi i biti početak jedne jako lijepe i dugogodišnje priče.

NEW PRODUCT – SCU-UV

NOVI PROIZVOD – SCU-UV

Igor Šercer

R&D Cleanroom

Inactivation of microorganisms in the air by means of UV radiation has been used for years. Initially used in medical facilities, the focus was on Mycobacterium tuberculosis, the agent that causes tuberculosis.

Ultraviolet radiation is electromagnetic radiation that can destroy the ability of microorganisms to multiply causing photochemical changes in nucleic acids. Wavelengths in the UV-C range are particularly harmful to cells because they are absorbed by nucleic acids.

That is why in the case of disinfection UV-C lamps operating at a wavelength of 253.7 nm are used. The efficiency of the filter contributes to the speed of microbial removal from the air, especially for large spores that are resistant to UV radiation. Filters in the G4 to F9 class range are commonly used. Filters also have a direct impact on the UV lamp as they clean the air before UV lamps, thereby reducing the accumulation of dust on the surface of the UV lamp wall. By placing the UV system just before the refrigerator in the duct we ensure the prevention of the formation of microorganisms on the surface of the refrigerator itself.

Mathematical model

Modeling of air and surface disinfection systems can be used to estimate the UV dose, which can then be used to determine the disinfection rate for specific microbes. UV field modeling can give fairly accurate results for the purpose of system sizing. Such a mathematical model is used according to ISO15714 standard as well.

Microbes exposed to UV radiation are subject to dosing (fluence) which is a function of radiation multiplied by the exposure time, as follows:

$$D = E_t \times I_R$$

Where:

D = UV exposure dose, J / m²

E_t = exposure time, sek

I_R = radiation, W / m²

When the UV dose leads to a 90% disinfection rate (10% survival), it is known as D90. The D90 value is typically used as an indicator of system size and can be used to assess the survival of individual microbes.

Influencing factors

Air flow rate in the duct

As the air flow rate in the duct increases, the efficiency of UV radiation decreases. This happens because the duration of exposure of the microorganism to UV radiation is reduced. The heat exchange on the wall of the UV lamp also increases, which leads to a decrease in the efficiency of the lamp itself.

Air temperature

The optimum air temperature in the duct is 20-22 °C. Higher or lower temperatures reduce the efficiency of the UV lamp.

Material reflection

By choosing the right housing material, the UV reflection can be increased by up to 75%. This directly means that we need a 75% weaker UV lamp in the system.

Testing

Microbiological testing can only be performed in a test laboratory.

Testing is performed according to the instructions from the ISO15714 standard. It is necessary to make a model that includes a fan, duct, UV circuit, and filters at the beginning and end of the duct mock up that ensure that the bacterial sample does not spread throughout the laboratory. Testing is performed by bringing the bacterial spore Bacillus subtilis inside the mock up, and taking air samples before and after the UV circuit.

Why use UV disinfection in ducts

- Easy installation in a new or existing duct system
- Negligible increase in duct pressure drop
- With air filtration, a high degree of disinfection is achieved
- Elimination of pathogenic microorganisms such as bacteria and viruses using UV technology
- Provides disinfected air in the room where you stay
- Reduces the risk of disease and the spread of airborne infections
- Makes rooms safe for your employees and customers

The available literature based on laboratory tests indicates the strength of the required dose of UV radiation for different microorganisms, which allows us to calculate and design systems for the exact target group of viruses and bacteria, as well as for different rates of disinfection. Currently developed standard sizes of SCU-UV systems are suitable for air disinfection for the most common viruses and bacteria present in ventilation systems, at the most commonly designed air flow rates.

Inaktivacija mikroorganizama u zraku pomoću UV zračenja koristi se već godinama. U samim početcima koristila se u medicinskim objektima, a usmjerenost je bila na Mycobacterium tuberculosis, agensu koji uzrokuje tuberkulozu. Ultraljubičasto zračenje elektromagnetsko je zračenje koje može uništiti sposobnost razmnožavanja mikroorganizama, uzrokujući fotokemijske promjene nukleinskih kiselina. Valne duljine u UV-C rasponu posebno su štetne za stanice jer ih apsorbiraju nukleinske kiseline.

Zbog toga se u slučaju dezinfekcije koriste UV-C lampe koje rade na valnoj duljini od 253,7 nm. Učinkovitost filtera doprinosi brzini uklanjanja mikroba iz zraka, posebno za velike spore koje su otporne na UV zračenje. Uobičajeno se koriste filteri u rasponu klase od G4 do F9. Filteri također imaju direktan utjecaj na UV lampu jer čiste zrak prije UV lampa, a time smanjuju nakupljanje prašine na površini stijenke UV lampe. Postavljanjem UV sustava neposredno prije hladnjaka u kanalu osiguravamo sprječavanje nastanka mikroorganizama na površini samog hladnjaka.

Matematički model

Modeliranje sustava za zračnu i površinsku dezinfekciju može se koristiti za procjenu doze UV-a, koja se zatim može koristiti za određivanje stope dezinfekcije za određene mikrobe. Modeliranje polja UV zračenja može dati prilično točne rezultate u svrhu dimenzioniranja sustava. Takav matematički model koristi se i prema normi ISO15714. Mikrobi izloženi UV zračenju podliježu doziranju (fluence), koje je funkcija zračenja pomnožena s vremenom izlaganja, kako slijedi:

$$D = E_t \times I_R$$

Pri čemu su:

D = doza izloženosti UV, J / m²

E_t = vrijeme izloženosti, sek

I_R = zračenje, W / m²

Kada UV doza dovede do 90% stope dezinfekcije (10% preživlja-

vanja), to je poznato kao D90. Vrijednost D90 obično se koristi kao pokazatelj veličine sustava i može se koristiti za procjenu preživljavanja pojedinih mikroba.

Utjecajni čimbenici

Brzina strujanja zraka u kanalu:

Povećanjem brzine strujanja zraka u kanalu efikasnost UV zračenja pada. To se događa jer se smanjuje vrijeme trajanja izloženosti mikroorganizma UV zračenju. Također se povećava i izmjena topline na stijenki UV lampe, što dovodi do smanjenja efikasnosti lampe.

Temperatura zraka:

Optimalna temperatura zraka u kanalu iznosi od 20 do 22 °C. Više ili niže temperature dovode do smanjenja efikasnosti UV lampe.

Refleksija materijala:

Izborom odgovarajućeg materijala kućišta, refleksija UV zraka može se povećati i do 75%. To direktno znači da nam treba 75% slabija UV lampa u sustavu.

Testiranje

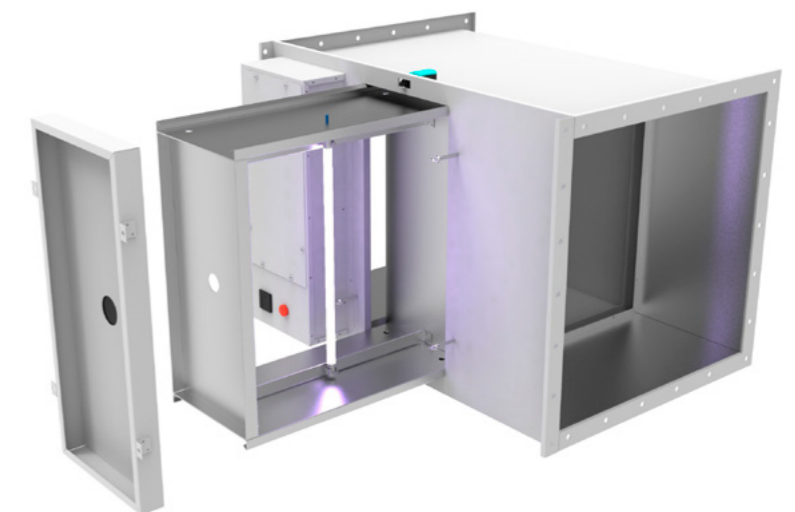
Mikrobiološko testiranje moguće je izvršiti samo u testnom laboratoriju. Testiranje se radi prema nalogu iz norme ISO15714. Potrebno je izraditi maketu koja uključuje ventilator, kanal, UV sklop te filtere na početku i kraju makete kanala koji osiguravaju da

se uzorak bakterije ne proširi po laboratoriju. Testiranje se odvija dovođenjem bakterijske spore Bacillus subtilis unutar makete te se uzimaju uzorci zraka prije i nakon UV sklopa.

Zašto koristiti sustav UV dezinfekcije u kanalima

- Jednostavna ugradnja u novi ili postojeći kanalni sustav
- Zanimljivo povećanje pada tlaka u kanalu
- Uz filtraciju zraka, postiže se visok stupanj dezinfekcije
- Eliminacija patogenih mikroorganizama poput bakterija i virusa korištenjem UV tehnologije
- Osigurava dezinficiran zrak u prostoru u kojem boravite
- Smanjuje rizik obolijevanja i širenja zaraze zrakom
- Čini prostore sigurnima za vaše djelatnike i klijente

Dostupna literatura temeljena na laboratorijskim ispitivanjima ukazuje na jačinu potrebne doze UV zračenja za različite mikroorganizme, što nam omogućava izračun i izradu sustava za ciljane skupine virusa i bakterija, ali i za različite stope dezinfekcije. Trenutačno razvijene standardne veličine SCU-UV sustava pogodne su za dezinfekciju zraka za najčešće prisutne viruse i bakterije u ventilacijskim sustavima pri najčešće projektiranim brzinama strujanja zraka.



Exploded product display | Eksplodirani prikaz proizvoda

NEW PRODUCT – HEAT RECOVERY UNIT WITH COUNTER-FLOW HEAT EXCHANGER

NOVI PROIZVOD – REKUPERATOR

Ivan Šimić

Area sales manager

Heat recovery units with counter-flow heat exchanger are characterized by heat exchange without direct contact of the media. With a heat recovery unit, the heat is exchanged between the fresh and exhaust air streams. In the heating mode, heat is transferred from the exhaust air stream to the fresh air stream and thus the fresh air stream is heated, while in the cooling mode the heat exchange direction is reversed, so the fresh air stream is cooled. In this way, heat is recovered from the exhaust air – energy that would otherwise be unused and thrown into the environment is now used to heat or cool the fresh air. Since the heat recovery units with counter-flow heat exchanger do not have direct contact between the fresh and exhaust air streams, only the return of sensible, but not latent, thermal energy is possible.

Although the installation of heat recovery units increases investment costs, their application reduces operating costs (energy savings required for heating and cooling) and protects the environment. It should be mentioned that according to the Technical Regulation on Rational Use of Energy and Thermal Protection in Buildings the installation of a system for heat recovery from exhaust air is mandatory in buildings ventila-

ted by a mechanical device, if the number of air changes per hour exceeds 0,7 h⁻¹ and with fresh air flow greater than 2.500 m³/h.

The efficiency of a heat recovery unit is expressed by the degree of heat recovery efficiency, which is defined as the ratio of the change in the enthalpy of the fresh air and the difference between the input enthalpy of the fresh air and the input enthalpy of the exhaust air (enthalpy transfer efficiency). In case of equal mass flows of fresh and exhaust air, the degree of heat recovery is reduced to the ratio of temperature differences (temperature transfer efficiency; left image).

Heat recovery unit components

The main components of the heat recovery unit are a counter-flow or cross-flow heat exchanger, filters, fans, a bypass and a control system (right image).

The heat exchange between the fresh and exhaust air streams takes place in the counter-flow heat exchanger. In HVAC systems, a heat exchanger made of aluminum sheets is most commonly used. Key features of the plate heat exchanger are a heat recovery efficiency, low leakage which prevents the mixing of the currents of the fresh and exhaust air and the lowest possible pressure drop. Filters improve air quality and pro-

tect the components. Desirable filter characteristics are high efficiency, low permeability and low pressure drop.

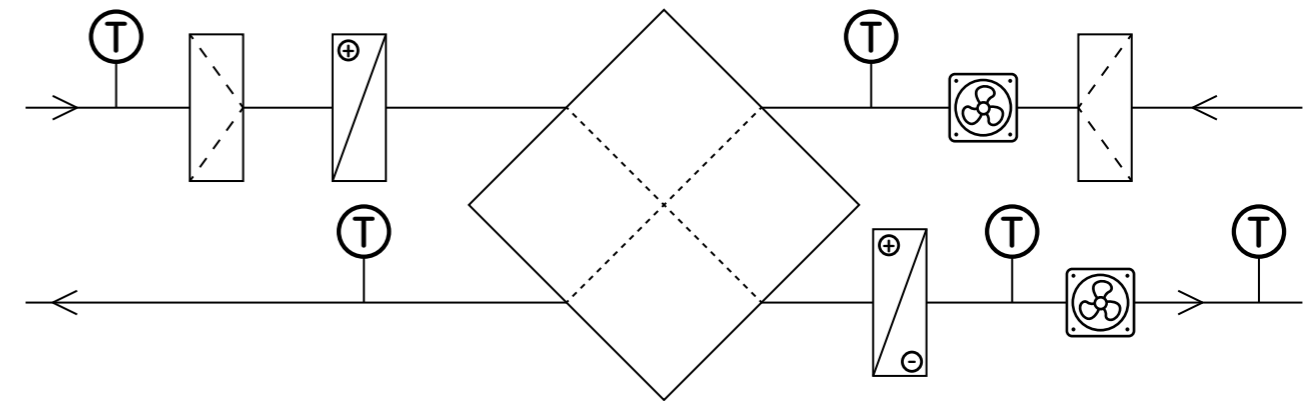
Fans supply fresh air to the room and suck out the exhaust air. Centrifugal fans with backward-curved blades are often installed in HVAC systems. The fans provide the required airflow and control the pressure drop – in the heat recovery unit itself and in the rest of the system.

The bypass controls the performance and is also used to prevent the formation of ice on the heat exchanger. Namely, at low outside temperatures, moisture can condense on the exhaust air side and ice can be formed, which reduces the effective surface area of the heat exchanger, thus reducing the degree of heat recovery and airflow.

The control system consists of electronic components and pressure and temperature sensors, and it combines the previously listed elements into a functional unit. For the end user, one of the most important features of this system is being user-friendly.

Other components of the heat recovery unit include a preheater and a heater and / or refrigerator. In climates where, due to low external temperatures, it is realistic to expect frequent ice to appear on the plate heat exchanger, a preheater is installed before the plate heat exchanger. The preheater increases energy consumption, thus, in addition to investment, further increases operating costs.

When the heat recovery unit is used to reach the setpoint temperature of supply air during the heating and / or cooling season, a heater and / or cooler is installed after the plate heat exchanger. Possible solutions are an electric heater, a two-pipe heat exchanger for heating or cooling, a four-pipe heat exchanger for heating and cooling, a direct expansion and a heat pump.



Recuperator components | Komponente rekuperatora

Rekuperatori su uređaji za povrat topline, a karakterizira ih izmjena topline bez izravnog kontakta medija. Kod rekuperatora, toplina se izmjenjuje između struja vanjskog i istrošenog zraka. U režimu grijanja toplina se prenosi sa struje istrošenog na struju vanjskog zraka te se time struja vanjskog zraka zagrijava, dok je u režimu hlađenja smjer izmjene topline obratan pa se struja vanjskog zraka hladi. Na taj se način ostvaruje povrat topline iz istrošenog zraka – energija koja bi se inače neiskorištena bacila u okoliš, sada se koristi za zagrijavanje ili ohlađivanje vanjskog zraka. S obzirom na to da kod rekuperatora nema izravnog kontakta između struja vanjskog i istrošenog zraka, moguć je samo povrat osjetne, ali ne i latentne, toplinske energije.

lako ugradnja rekuperatora povećava investicijske troškove, njihovim korištenjem smanjuju se pogonski troškovi (ušteda energije potrebne za grijanje i hlađenje) i štiti okoliš. Valja spomenuti da je, prema Tehničkom propisu o racionalnoj uporabi energije i toplinskoj zaštiti u zgradama, ugradnja sustava za povrat topline iz istrošenog zraka obvezna u zgradama koje se ventiliraju mehaničkim uređajem ako je broj izmjena zraka veći od 0,7 h⁻¹, a protok vanjskog zraka veći od 2.500 m³/h.

Efikasnost rekuperatora iskazuje se stupnjem povrata topline koji se definira kao omjer promjene entalpije vanjskog zraka i razlike

između ulazne entalpije vanjskog zraka te ulazne entalpije istrošenog zraka. U slučaju jednakih masenih protoka struja vanjskog i istrošenog zraka, stupanj povrata topline svodi se na omjer temperaturnih razlika:

Komponente rekuperatora

Glavne su komponente rekuperatora protusmjerni ili križni pločasti izmjenjivač topline, filteri, ventilatori, obilazni vod (bypass) i sustav automatskog upravljanja.

Izmjena topline između struja vanjskog i istrošenog zraka odvija se u pločastom izmjenjivaču topline. U zračnim GviK sustavima najčešće se koristi pločasti izmjenjivač izrađen od aluminijskog lima. Bitne su karakteristike pločastog izmjenjivača topline visok stupanj povrata topline, niska propusnost koja onemogućava miješanje struja vanjskog i istrošenog zraka te što niži pad tlaka.

Filteri poboljšavaju kvalitetu zraka i štite opremu od onečišćenja. Poželjne karakteristike filtera su visoka učinkovitost, niska propusnost i nizak pad tlaka.

Ventilatori dobivaju vanjski zrak u prostoriju te iz nje odsisavaju istrošeni zrak. U zračnim GviK sustavima često se ugrađuju centrifugalni ventilatori s lopaticama zakrivljenima unatrag. Ventilator omogućava traženi protok zraka te savladava padove tlaka – u samom rekuperatoru te u ostatku sustava. Obilazni vod izvršava regulaciju

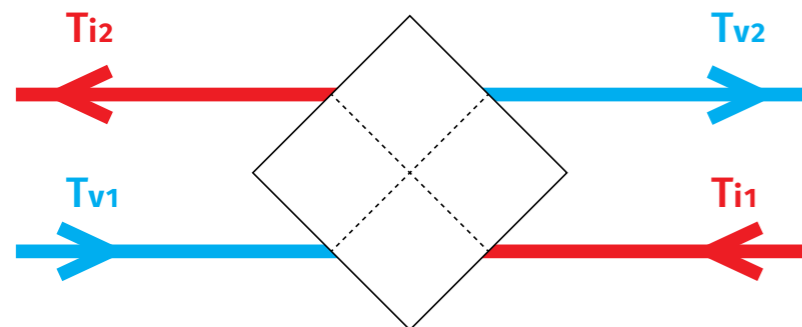
učinka, a koristi se i za sprječavanje stvaranja leda na pločastom izmjenjivaču topline. Naime, pri niskim temperaturama vanjskog zraka može doći do kondenzacije vlage na strani istrošenog zraka te je moguće stvaranje leda koje smanjuje efektivnu površinu izmjenjivača topline, a time se smanjuje i stupanj povrata topline te protok zraka.

Sustav automatskog upravljanja čine elektroničke komponente te osjetnici tlaka i temperature, a on objedinjuje prethodno nabrojane elemente u funkcionalnu cjelinu. Za krajnjeg korisnika jedna od najbitnijih odlika tog sustava jest jednostavnost korištenja.

Od ostalih komponenata rekuperatora izdvajaju se predgrijač te grijač i/ili hladnjak.

U klimama u kojima je zbog niskih vanjskih temperatura realno očekivanje čestog pojavljivanja leda na pločastom izmjenjivaču topline, prije pločastog izmjenjivača ugrađuje se predgrijač. Predgrijač povećava potrošnju energije pa tako, osim investicijskih, povećava i pogonske troškove.

Kad se rekuperatorom želi postići zadanu temperaturu dobavnog zraka tijekom sezone grijanja i/ili hlađenja, nakon pločastog izmjenjivača topline ugrađuje se grijač i/ili hladnjak. Moguće izvedbe su električni grijač, dvocijevni izmjenjivač topline za grijanje ili hlađenje, četverocijevni izmjenjivač topline za grijanje i hlađenje, direktni isparivač i dizalica topline.



Principle of operation of the recuperator | Princip rada rekuperatora

WHAT IS A VIRTUAL POWER PLANT?

ŠTO JE VIRTUALNA ELEKTRANA?

Marko Lasić

Business Unit Director

Under the pressure of climate change, the European Union is leading the transition to clean energy production through the Clean Energy for All Europeans Directive, which mandates carbon neutrality of all members by the end of 2050. With the liberalization of power systems in Europe and around the world, new business models have been developed, of which the virtual power plant is one of the most important. The reason for this rests on the increasing integration of distributed renewable energy sources into buildings and

the opening of smaller private power plants. The downside of these types of sources is their volatility of energy delivery to the transmission system, which can lead to fluctuations in the frequency of the current.

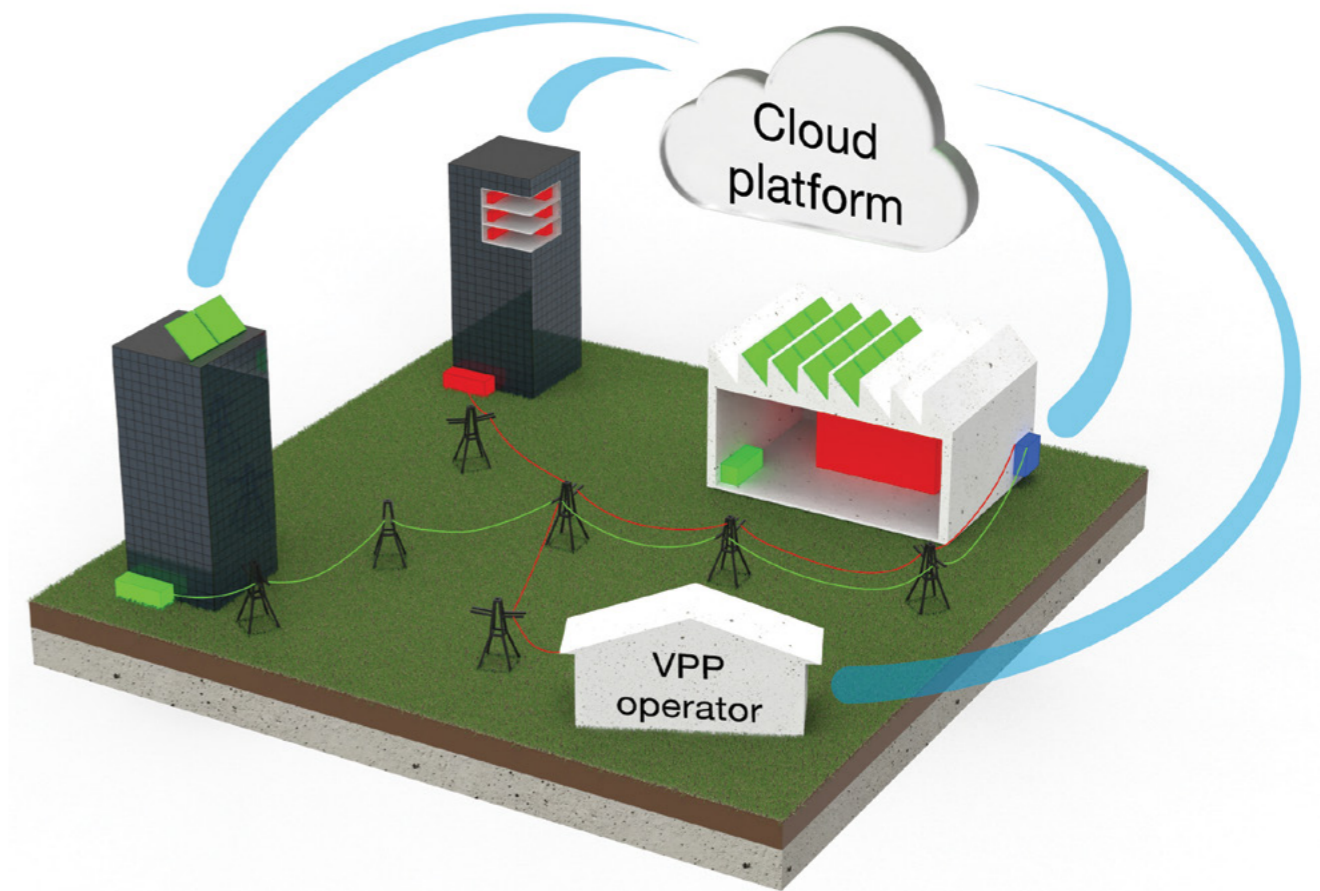
In order to prevent imbalance, the new participants aggregate different energy sources on the market into a so-called virtual power plant and thus become aggregators, i.e. operators of virtual power plants. Due to small individual strengths and the inability of small producers to represent themselves in the market, aggregators serve as intermediaries that allow source owners to participate in the market. In addition to production, the system can be maintained with

higher consumption, which leads to greater complexity. Therefore, it is up to the aggregator to maintain the balance in direct communication with the transmission system operator by turning the sources and consumers on or off.

In addition to system balancing, other business models allow direct trading of electricity from connected sources. However, this can only be found in fully liberalized markets of Western and Northern Europe such as Norway, the United Kingdom and Germany. The Croatian market is currently in the process of liberalization and for now we rely on traditional ways of energy production.



KOER Energy Cloud concept | KOER Energy Cloud koncept



Working principle of KOER Energy Cloud | Princip rada KOER Energy Cloud-a

Pod pritiskom klimatskih promjena, Europska Unija predvodi prijelaz prema čistoj proizvodnji energije direktivom „Clean Energy for all Europeans“, koja nalaže ugljičnu neutralnost svih članica do kraja 2050. Uz liberalizaciju elektroenergetskih sustava u Europi i diljem svijeta, došlo je do razvitka novih poslovnih modela, od kojih je virtualna elektrana jedan od najbitnijih. Razlog je sve veća integracija distribuiranih obnovljivih izvora energije u zgrade i otvaranje manjih privatnih elektrana. Mana je ovih tipova izvora volatilnost isporuke energije u prijenosni

sustav, čime može doći do fluktuacije u frekvenciji struje. Kako bi spriječili disbalans, novi sudionici agregiraju različite izvore energije na tržištu u takozvanu virtualnu elektranu i time postaju agregatori, odnosno operatori virtualnih elektrana. Zbog malih individualnih snaga i nemogućnosti malih proizvođača da se sami zastupaju na tržištu, agregatori služe kao posrednici koji omogućuju vlasnicima izvora sudjelovanje na tržištu. Osim proizvodnje, sustav se može održavati i većom potrošnjom, čime se povećava kompleksnost. Stoga, agregator

u direktnoj komunikaciji s operaterom prijenosnog sustava održava balans paljenjem ili gašenjem izvora i trošila. Osim balansiranja sustava, ostali poslovni modeli omogućuju direktno trgovanje strujom iz priključenih izvora. Međutim, to se može naći samo na potpuno liberaliziranim tržištima zapadne i sjeverne Europe, poput Norveške, Ujedinjenog Kraljevstva i Njemačke. Hrvatsko je tržište trenutno u procesu liberalizacije te se zasad oslanjamo na tradicionalne načine proizvodnje energije.

SOFTWARE FOR MANAGING AND COLLABORATING CAD DOCUMENTATION

SOFTWARE ZA UPRAVLJANJE I KOLABORACIJU CAD DOKUMENTACIJE

Siniša Murtezanović

Chief Technical Officer

Along with the growth of the company and its number of employees, the need for management tools increases, too. The same goes with the technical documentation. Exponential growth of the company is a direct consequence of development projects within which new products or new product versions have been developed. The extension of the product range and increasing of stringent market requirements, as well as our own quality system in terms of orderliness and completeness of technical documentation, has led us to devise solutions for monitoring and managing technical documentation.

Autodesk's solution Vault has emerged as a logical choice as it meets all our needs in terms of managing technical documentation, and it being shared with eit-

her internal or external users. And from the perspective of accessing technical documentation through ERP, Vault has proven to be a good collaboration tool.

Issues with documentation management

In performing our tasks, we have encountered problems in the form of out-of-date, redundant technical documentation in several locations, which would be stored on a server and managed through an internet explorer.

We have found the crucial advantage of Vault to be in the centralized management of documentation without the possibility of it being duplicated, available to all users at all times.

About Vault

Software solution for centralized, organized and secure documentation management

among design, engineering and construction teams. It is used to monitor workflow and data management, control versions and projects revisions, as well as documenting processes in a multi-user environment.

Features:

- Documentation centralization
- Data security
- Data standardization
- Data reuse
- Facilitated documentation search
- Multiple queries and filters
- Tracking versions and revisions
- Simultaneous teamwork
- Project monitoring and reporting
- Integration with ERP
- Bill of materials management (BOM)
- Automated design change process
- Vault Office - for non-CAD users
- Web access



Search & reuse
Pretražite i ponovno upotrijebite

Concurrent design
Istovremeni dizajn

Any-CAD integration
Kompletna CAD integracija

Relationship tracking | Praćenje odnosa

Project organization
Organizacija projekta



Publishing & Viewing
Objavlivanje i gledanje

Content management
Upravljanje sadržajem

Lifecycle & Rev management
Upravljanje životnim ciklusom i obrtajima

Approvals
Odobrenja

Change management
Upravljanje promjenama



Security | Zaštita

Reporting
Izveštavanje

Web based & Remote access
Internetska baza i vanjski pristup

Multi-site replication
Replikacija na više mjesta

Enterprise integration
Integracija kopanje

Application possibilities | Mogućnosti primjene

Data

- Protection of intellectual property
- Storing and reusing engineering knowledge and previous projects
- BOM is automatically generated and is connected with source models




Podaci

- Zaštita intelektualnog vlasništva
- Pohrana i ponovno korištenje inženjerskog znanja i prethodnih projekata
- BOM se automatski generira i povezan je s izvornim modelima

People

- Engineers have overview of activities of all participants and can know what any person does at any moment
- Constructors on different locations work on the same data set
- Participants outside the engineering team can, depending on the rules, access updated data



Ljudi

- Inženjeri imaju pregled na aktivnostisvih sudionika i mogu znati što tko radi u svakom trenutku
- Konstruktori na različitim lokacijama rade na istom setu podataka
- Sudionici izvan inženjerskog tima mogu, ovisno o pravilima, pristupiti uvijek ažurnim podacima

Processes

- Control of revisions and history of origin (CAD and accompanying documentation)
- Data standardization can be conditioned or recommended
- Managing versions and requirements for changes



Procesi

- Kontrola revizija i povijesti nastanka (CAD i popratna dokumentacija)
- Standardizacija podataka može biti uvjetovana ili preporučena
- Upravljanje verzijama i zahtjevima za promjene

Autodesk Vault | Autodesk Vault

Uz rast tvrtke i broja zaposlenih, potreba za upravljačkim alatima postaje sve veća. Tako je i s tehničkom dokumentacijom. Intezivan rast poduzeća direktna je posljedica razvojnih projekata u sklopu kojih su se razvili i novi proizvodi ili nove varijante proizvoda. Porast palete proizvoda i sve strožih zahtjeva tržišta, a i vlastitog sustava kvalitete po pitanju urednosti i kompletnosti tehničke dokumentacije, usmjerio nas je k pronalasku rješenja za praćenje i upravljanje tehničkom dokumentacijom. Autodeskovo rješenje Vault nametnulo se kao logičan odabir s obzirom na udovoljavanje svim našim potrebama upravljanja tehničkom dokumentacijom te razmjene spomenute, bilo da se radi o internim ili eksternim korisnicima. Također, iz perspektive pristupanja tehničkoj dokumentaciji kroz ERP, Vault se pokazao kao dobar kolaboracij-

ski alat.

Problematika

U dosadašnjem radu nailazili smo na probleme u obliku neažurne, redundantne tehničke dokumentacije na više lokacija, koja se pohranjivala na server i njome se upravljalo na internetskim. Kao najbitniju prednost Vaulta prepoznali smo centralizirano vođenje dokumentacije koja je uvijek dostupna svim korisnicima, bez mogućnosti dupliciranja spomenute.

O Vaultu

Vault je softversko rješenje za centralizirano, organizirano i sigurno upravljanje dokumentacijom unutar dizajnerskih, inženjerskih i konstrukcijskih timova. Koristi se za praćenje tijeka rada

i upravljanje podacima, kontroliranje verzija i revizija projekata te dokumentiranje procesa u višekorisničkom okruženju.

Značajke:

- Centralizacija dokumentacije
- Sigurnost podataka
- Standardizacija podataka
- Ponovno korištenje podataka
- Olakšano pretraživanje dokumentacije
- Višestruki upiti i filteri
- Praćenje verzija i revizija
- Simultani timski rad
- Praćenje projekata i izrada izvještaja
- Integracija s ERP-om
- Upravljanje popisom materijala (BOM)
- Automatizirani proces izmjene dizajna
- Vault Office – za non-CAD korisnike
- Mrežni pristup.

DIGITAL TRANSFORMATION OF PANEL PRODUCTION FOR CLEANROOMS

DIGITALNA TRANSFORMACIJA PROIZVODNJE PANELA ZA ČISTE PROSTORE

Marko Smolec

R&D robotics and automation

The line for the production of panels for cleanrooms has since the very beginning integrated high technology and enabled the production of all sizes and types of panels, regardless of material, filling, openings, etc. Its work is constantly improved by us tracking production, downtime and iterations, production cycle is shortened and maintenance costs reduced, without the quality of the final product being affected.

To minimize the possibility of human error, speed up the Design-to-Production process, and ultimately reduce the chain of people needed to produce a panel, three applications have been developed that make this possible.

PanelEx is a software that makes it easy to draw a panel and parameterize it down to the smallest detail, including openings. The program is designed to work project-based, so it is possible to make a whole series of panels and obtain the necessary documentation for commissioning. We are constantly improving it with additional functionalities. In the near future, the same software is

planned to be used for our other products as well, such as doors.

Once we have a table with a list of panels to be produced, either generated by Revit, production preparation or PanelEx application, we simply generate the required machine code (G code) for production via the PanelGen application. Other than significant savings in employees' working hours, upsides of PanelGen are the elimination of human error and creation of the necessary programs to work without any knowledge or experience in programming. The same allows that in the event of an emergency or crisis situation in production, an authorized person can easily place an order in production.

Finally, once we have everything defined in terms of production, the only thing left is the palletization of the order. So as to optimally and easily compile the pallet list, **PanelStack** was developed. PanelStack is software that defines the order of production of panels according to project requirements and creates a graphic display and production sequence of each pallet. In addition to creating documentation, the program simultaneously communicates

with process devices and robots on the line. Thus each device is instructed in what comes to its workplace next and reports back by means of the same communication channel what is complete and arranged on the pallet.

OT network (operational technologies)

The main prerequisite for further improvement and digitization of the entire line and the production process itself is communication between all system components (controllers that control over 80 active axes on the line for cleanrooms). Through close cooperation with Siemens d.d. we are working on the integration of secure and efficient communication in an industrial environment, whose main focus is reliable and time-critical data transmission. Unlike an IT network, short-term interruptions in communication can cause major difficulties and downtime in production.

Through many examples in industry where a poor or unprotected industrial network has been the cause of major downtime and even indirect cause of danger to employees, security on the

Linija proizvodnje panela za čiste prostore od samog je početka rada integrirala visoku tehnologiju i omogućila proizvodnju svih veličina i tipova panela, neovisno o materijalu, ispuni, otvorima i sl. Praćenjem proizvodnje, zastoja i operacijskih taktova, konstantno unaprjeđujemo njezin rad, skraćujemo proizvodni ciklus te smanjujemo troškove održavanja bez utjecaja na kvalitetu završnog proizvoda.

Kako bismo smanjili mogućnost ljudske pogreške, ubrzali Design-to-Production proces te u konačnici smanjili lanac ljudi potreban za proizvodnju panela, razvijene su tri aplikacije koje to omogućuju.

PanelEx je softver pomoću kojeg je lako nacrtati panel te ga parametrirati do najsitnijih detalja, uključujući i otvore. Program je zamišljen da radi projektno pa je tako moguće izraditi niz panela i dobiti potrebnu dokumentaciju za puštanje u rad. Konstantno ga unaprjeđujemo dodatnim funkcionalnostima. U skorijoj se budućnosti spomenuti softver planira koristiti i za naše druge proizvode, poput vrata.

Kada imamo tablicu s popisom panela koje je potrebno proizvesti, generiranu Revitom, pripremom proizvodnje ili PanelEx aplikacijom, PanelGen aplikacijom jednostavno generiramo potreban strojni kod (G kod) za proizvodnju. Osim što znatno štedimo na ljudskim satima, prednosti su PanelGena eliminacija ljudske pogreške i izrada potrebnih programa za rad bez ikakvog znanja ili iskustva u programiranju. Omogućava i da ovlaštena osoba može bez problema pustiti nalog u proizvodnju u slučaju hitne ili krizne situacije u proizvodnji.

Konačno, kada je sve što se tiče izrade definirano, jedino što preostaje jest paletizacija naloga. Kako bismo optimalno i jednostavno složili paletnu listu, razvijen je PanelStack. PanelStack je softver koji prema projektnim zahtjevima definira redosljed proizvodnje panela te izrađuje grafički prikaz i

„The next trillion dollars will be earned by data - for our customers and for our industry.”

(Michael Dell, founder of Dell)

„Digitization is the main reason for the disappearance of more than half of the Fortune 500 companies from 2.000 until today.”

(Pierre Nanterme, CEO of Accenture)

„Sljedećih bilijun dolara zaradit će se podacima – za naše klijente i za našu industriju.”

(Michael Dell, osnivač tvrtke Dell)

„Digitalizacija je glavni razlog nestanka više od polovice tvrtaka s popisa Fortune 500, od 2000. godine do danas.”

(Pierre Nanterme, CEO tvrtke Accenture)

proizvodni slijed svake palete. Uz izradu dokumentacije, program istovremeno komunicira s procesnim uređajima i robotima na liniji. Tako je svaki uređaj upućen u sljedeće što dolazi na njegovo radno mjesto te spomenutim komunikacijskim kanalom povratno javlja što je gotovo i složeno na paletu.

OT mreža (operativne tehnologije)

Glavni preduvjet za daljnje unaprjeđenje i digitalizaciju cijele linije te samog proizvodnog procesa jest komunikacija između svih komponenata sustava (kontrolera koji upravljaju s više od osamdeset aktivnih osi na liniji za čiste prostore). Bliskom suradnjom s tvrtkom Siemens d.d., radimo na integraciji sigurne i efikasne komunikacije u industrijskom okruženju, kojoj je glavni fokus pouzdani i vremenski kritični prijenos podataka. Za razliku od IT mreže, kratkotrajni prekidi u komunikaciji mogu uzrokovati velike poteškoće i zastoje u proizvodnji.

Mnoštvom primjera u industriji pri kojima je loša, nezaštićena industrijska mreža bila uzrok velikih zastoja i prekida ili čak indirektan uzrok opasnosti za djelatnike, sigurnost na komunikacijskom nivou nameće se kao prioritet za hitnu i kvalitetno strukturiranu implementaciju u proizvodnji. Osim navedenog, spomenuta mreža koristit će se za real-time nadgledanje,

održavanje i servis linija direktno iz udaljenog odjela u Samoboru, čime se smanjuje potreba za putovanjem i dodatnim troškovima.

Sustav gospodarenja energijom (EMS)

Trenutno je u razvoju sustav gospodarenja energijom, EMS, koji će se implementirati u cijelom pogonu, dok će se pilot projekt implementirati na liniji za proizvodnju panela. Sustav će aktivno prikupljati podatke o potrošnji i gubitcima svih oblika energije u pogonu. Dobivene će se informacije obrađivati i koristiti za optimizaciju i predikciju potrošnje te pametno planiranje troškova održavanja i proizvodnje. Kao najbrži povrat investicije vidimo redukcije u smjeru curenja i rasipanja energentima u vremenu hladnog pogona, što će donijeti znatne uštede odmah nakon implementacije. Sve je spomenuto jako važno, kako za financijski i proizvodni (kvaliteta električne energije, propadi napona, prekid električne energije, itd.), tako i za ekološki aspekt, koji postaje sve bitniji u globalnoj viziji Klimaoopreme i u zahtjevima kupaca i poslovnih suradnika.

Ukupna učinkovitost opreme

Jedan od instrumenata koji se paralelno implementira na liniji je OEE, mjera koja pokazuje koliko se dobro koristi proizvodni postupak



Software icon design | Dizajn ikona softvera



Energy Management Software | Sustav gospodarenja energijom

communication level is imposed as a priority for urgent and well-structured implementation in production. In addition to the above mentioned, the same network will be used for real-time monitoring, maintenance and service of lines directly from a remote department in Samobor, thus reducing the need for travel and additional costs.

Energy Management Software

An energy management system, EMS, is currently being developed, which will be implemented throughout the plant, and a pilot project on the panel production line. The system will actively collect data on consumption and losses of all forms of energy in the plant. The obtained information will be processed and used for optimization and prediction of consumption, as well as smart planning of maintenance and production costs. As the fastest return on investment, we see reductions in the direction of leakage and waste of energy during the plant's low operation mode, which will bring significant savings immediately after implementation. All of the above is of great importance, both for financial and production (electricity quality, voltage failures, power outages, etc.) and for the environmental aspect, which is gaining relevance in the global vision of Klimaoprema and in the requirements of customers and business associates.

Overall equipment effectiveness

One of the instruments parallel implemented on the line is OEE, a measure that shows how well the production process (plant, time and material) is used in relation to its full potential. We are going to deploy the already installed equipment in the plant to collect data on the operation, cycles and downtime of each individual machine and part of the production line. This way we will obtain actual and reliable information on the efficiency of each, which is the basis for further optimization and improvement of the production process and monitoring according to key performance indicators (KPI).

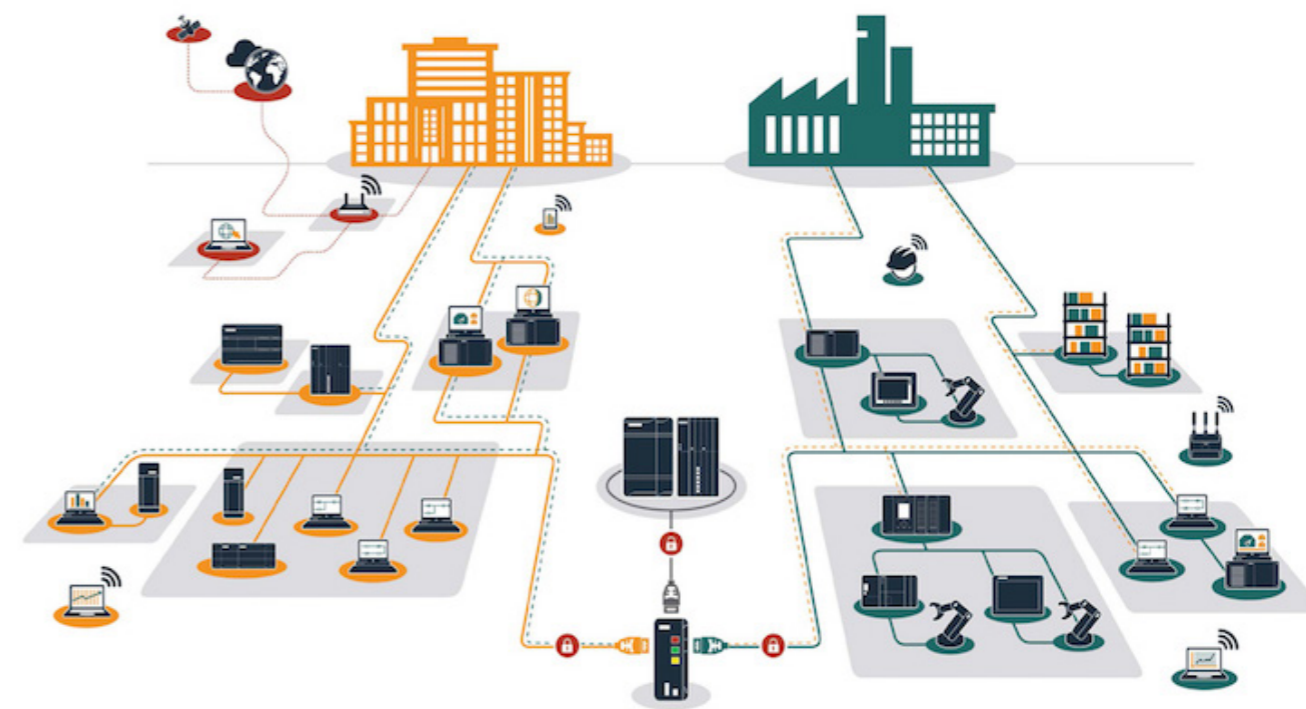
Factory Floor Feedback

Aiming to achieve paper-free operation, easy issuance and tracking of work orders and accurate records of machine operation and downtime, it is important to have a proper communication system with production. For this purpose, "kiosks" are being developed, according to the example of a model that I am already implementing in our well-known plants and will be installed on the line for cleanrooms. The kiosk is an "info point" with a user interface and a barcode reader where any worker in the plant can scan and see work orders for the selected working day, and can give feedback for the same or feedback on difficulties /

problems that occur on that production line. Feedback on machine condition, downtime and other shortcomings that cause production downtime can be re-entered directly into the database of the parent MES system, and forwarded to the future ERP system that will use the information to optimize and plan production. It will also be used to enter the remaining energy sources and can be accessed via a mobile application (monitoring the production and operation of machines via Android / iOS applications and web servers).

Industry 4.0

As each segment of the mentioned technology is optimized and perfected on the 'test model', the same model is copied to each line and thus through a safe, structured and verified way we digitize and modernize the entire drive. The goal is to meet all the prerequisites for the integration of "Industry 4.0" in the shortest possible time and to create a model of a modern factory with a by-product of lower operating costs, modern communication and security, and increased productivity. For a modern manufacturing company to truly reach the top, it must embrace the changes, advances and disruptions brought about by digital transformation and keep in mind a comprehensive and global view of the technology that must be adopted by every person in the chain of successful implementation. This is the next step for Klimaoprema d.d. and its development.



Information Technologies (IT) Vs Operational Technologies (OT)
Informacijske tehnologije (IT) protiv operativnih tehnologija (OT)

(postrojenje, vrijeme i materijal) u odnosu na njegov puni potencijal. Već instaliranu opremu u pogonu koristit ćemo za prikupljanje podataka o radu, ciklusima i zastoju svakog pojedinog stroja i dijela proizvodne linije. Tako ćemo dobiti stvarne i pouzdane informacije o efikasnosti spomenutog, što je temelj za daljnju optimizaciju i poboljšanje proizvodnog procesa te praćenje prema ključnim pokazateljima performansa (KPI).

Kiosci za praćenje proizvodnje

U cilju postizanja paper-free pogona, jednostavnog izdavanja i praćenja radnih naloga te točnih evidencija o radu strojeva i zastoju, bitno je imati dobar sustav komunikacije s proizvodnjom. U tu svrhu razvijaju se kiosci, prema primjeru modela koji je već kvalitetno implementiran u nama poznatim pogonima te će se instalirati na liniji za čiste prostore. Kiosk je info point s korisničkim sučeljem i barkod čitačem. Pomoću njega bilo koji radnik u pogonu može skenirati i vidjeti radne naloge za odabrani radni dan te može dati povratnu informaciju za spomenuto ili javiti

poteškoće koje se javljaju na toj proizvodnoj liniji. Povratne informacije o stanju strojeva, zastoju i ostalim nedostacima koji uzrokuju zastoje u proizvodnji moguće je upisati direktno u bazu podataka nadređenog MES sustava te ih prosljediti prema budućem ERP sustavu koji će dobivene informacije koristiti za optimizaciju i planiranje proizvodnje. Isto tako, koristit će se za upis preostalih energenata i može mu se pristupiti preko mobilne aplikacije (praćenje proizvodnje i rada strojeva preko android/iOS aplikacije i mrežnog servera).

Industrija 4.0

Kako se koji segment spomenute tehnologije optimizira i usavršava na testnom modelu, navedeni se model kopira na svaku liniju i tako kroz siguran, strukturiran i provjeren način digitaliziramo i moderniziramo cijeli pogon. Cilj je u što kraćem vremenu ispuniti sve preduvjete za integraciju Industrije 4.0 i stvaranje oglednog primjera moderne tvornice uz nusprodukt nižih operativnih troškova, suvremenu komunikaciju i sigurnost te povećanu produktivnost. Kako

bi suvremena proizvodna tvrtka doista došla na vrh, ona mora prihvatiti promjene, napredak i poremećaje koje donosi digitalna transformacija te imati na umu sveobuhvatni i globalni pogled na tehnologiju koju mora usvojiti svaka osoba u lancu uspješne implementacije. To je idući korak za Klimaoprema d.d. i njezin razvoj.

DIAGNOSIS OF HVAC SYSTEM MALFUNCTION BY MEANS OF TREND ANALYSIS

DIJAGNOZA KVARA U RADU HVAC SUSTAVA POMOĆU ANALIZE TRENDNA

Tomislav Burazović

Head of service, maintenance and validation

Use of BMS / SCADA system in maintaining set parameters

Automation tools have been used in the management of various systems for many years. For smaller drives they are just being introduced, and for more complex systems they are imperative. In all cleanrooms, in any branch of industry, there is always an additional requirement to monitor the parameters of some units that make

that space suitable for the activity for which it is intended. As a rule, these are pressure, temperature and relative humidity of the room. An example of a system that controls the operation of the air conditioning chamber and the maintenance of parameters in the rooms supplied by the air of the above air conditioning chamber can be seen in the following figures.

Here we have seen the principle of display of one manufacturer (SCADA system), but all of them are in recent times simple enough, readable and easy to use. The display mode and the number of parameters that are constantly monitored are always agreed dire-

ctly with the client. Apart from the fact that these systems are indispensable for fine-tuning the work, which is necessary for certain jobs to be done in the premises, they also serve as proof of the achieved parameters, a tool to justify certain production batches, to detect system failures or detection slippage of some values in order to prevent the violation of certain parameters in time. In this article, we will mostly deal with the last thesis, i.e. the analysis for the purpose of maintaining the HVAC system.

PARAMETRI SUSTAVA KK2



Figure 2. Overview of setting parameters of the air conditioning chamber
Slika 2. Prikaz postavnih parametara klimakomore

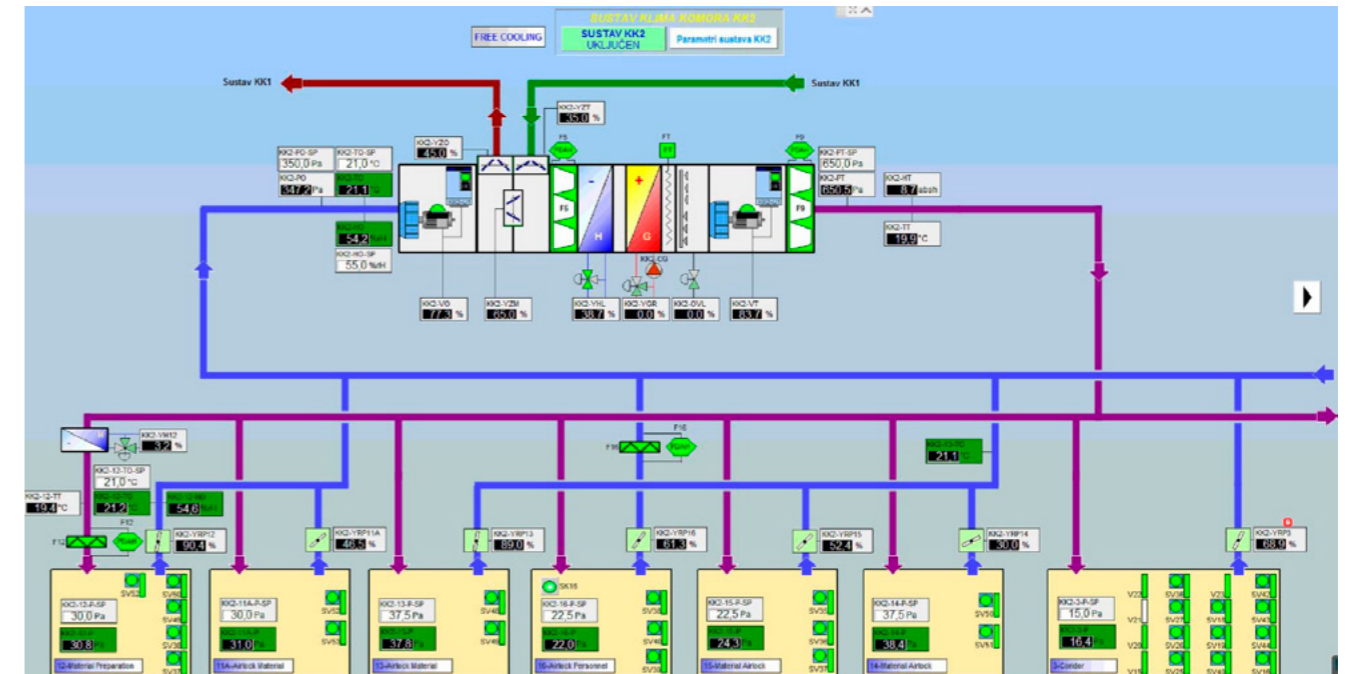


Figure 1. Overview of air conditioning chamber and cleanrooms with monitoring of important parameters
Slika 1. Prikaz klimakomore i čistih prostora s praćenjem bitnih parametara

Korištenje BMS / SCADA sustava u održavanju zadanih parametara

Već se niz godina u upravljanju različitim sustavima koriste alati automatike. Kod manjih pogona tek se uvode, a kod kompleksnijih sustava imperativ. U svim čistim prostorima, u bilo kojoj grani industrije, uvijek je dodatan zahtjev praćenje parametara nekih jedinica koje taj prostor i čine pogodnim za djelatnost kojoj je namijenjen. U pravilu su to tlak, temperatura i relativna vlaga prostora. Primjer sustava koji upravlja radom klimakomore i održavanje parametara u prostorima koje snabdjeva zrak navedene klimakomore možete vidjeti na sljedećim slikama. Ovdje smo vidjeli princip prikaza jednog proizvođača (SCADA sustava), ali svi su u novije vrijeme dovoljno jednostavnog prikaza, čitljivi i laki za korištenje. Način prikaza i broj parametara koji se konstantno prate uvijek se dogovaraju direktno s klijentom. Osim što su ovi sustavi prijeko potrebni radi finog podešavanja rada, što je nužno kako bi se određeni poslovi i mogli odrađivati u prostorima, oni služe i kao dokaz o postignutim parametrima, alat kojim se opravdavaju pojedine proizvodne se-

rije, za detekciju kvara na sustavu ili uočavanje otklizavanja poneke vrijednosti kako bi se na vrijeme spriječilo narušavanje pojedinih parametara. U ovom članku ponajviše ćemo se baviti posljednjom tezom, odnosno analizom u svrhu održavanja HVAC sustava.

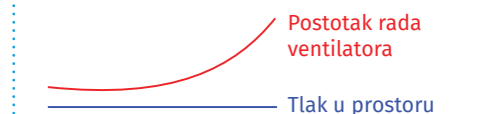
Korištenje BMS / SCADA sustava za analizu kvara

Alarm: Tlak prostora izvan je alarmnih granica

Moguće greške u radu:

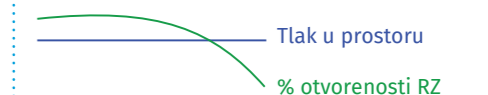
- a) nedovoljno zraka na dobavnoj strani sustava – zaprljani filteri
 - b) nedovoljno zraka na dobavnoj strani sustava – kvar na regulatoru (RKP, RVP)
 - c) kvar na odsisnom dijelu sustava
 - d) vrata ili neki drugi otvor remete vrijednosti zbog neadekvatnog rada (ovo ćemo anulirati jer je spomenuto prva stvar koju korisnik mora provjeriti prije prijave kvara).
- Moguće rješenje prilikom analize kvara:
- a) nedovoljno zraka na dobavnoj strani sustava – zaprljani filteri: I. Diferencijalni presostat aktivirao je alarm na 200 ili 400 Pa, potrebno je zamijeniti filtere (spomenuto bi se trebalo vidjeti i na trendu zaklopke na odsisu, koja bi se morala

više zatvarati u odnosu na startnu poziciju, zbog manje količine dobavnog zraka u prostoru). II. Dobavni ventilator radi na povećanoj frekvenciji / postotku rada (zbog većeg otpora na filterima, potrebno je više snage za savladavanje otpora; vidi sliku 4).



Slika 4. Prikaz trenda dobavnog ventilatora na BMS sustavu prilikom zaprljanja filtera

III. Zaklopka na odsisu otišla je na 0% (isto kao kod I. – na trendu je vidljiv pad otvorenosti kroz vrijeme; vidi sliku 5).



Slika 5. Prikaz trenda RZ na BMS sustavu prilikom zaprljanja filtera

Use of BMS / SCADA system for malfunction analysis

Alarm: The room pressure is outside the alarm limits

Possible operating errors:

- a) insufficient air on the supply side of the system - dirty filters
- b) insufficient air on the supply side of the system - malfunction on the regulator (RKP, RVP)
- c) failure of the exhaust part of the system
- d) door or other opening disturbs the value due to inadequate operation (we will exclude this as it is mentioned that this is the first thing that the user has to check before reporting the malfunction).

Possible solution when analyzing a malfunction:

- a) insufficient air on the supply side of the system - dirty filters:

I. The differential pressure switch has activated an alarm at 200 or 400 Pa, it is necessary to replace the filters (this should also be seen in the trend of the exhaust valve, which would have to close more than the starting position, due to less supply air in the room).
II. The supply fan operates at an increased frequency / percentage of operation (due to the higher resistance on the filters, more power is required to overcome the resistance; see Figure 4).

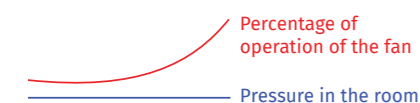


Figure 4. Display of the supply fan trend on the BMS system when the filter gets dirty

III. The valve on the exhaust went to 0% (same as in I. - the trend shows a decrease in openness over time; see Figure 5).

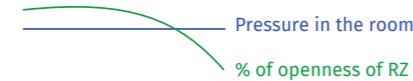


Figure 5. Display of the RZ trend on the BMS system during filter contamination

IV. Evidence of a smaller quantity on the supply is measured by a balometer in cleanroom or a Pitot-tube on the supply duct.

V. If we do not have a differential pressure switch on each filter, it is necessary to periodically measure the pressure drop on the filters. This can also serve as final proof of contamination before replacement.

- b) insufficient air on the supply side of the system - malfunction on the regulator (RKP, RVP)

I. If the pressure in the room drops or rises linearly on the trend display, and the fan is running at approximately the same value at the same time, it is possible that there is a physical blockage in the duct, drive failure, or someone disconnected the tube on the RVP drive. In any case, it is necessary to go out on the field and perform a control measurement and inspection before replacing the part.

- c) failure of the exhaust part of the system (see Figure 6):

I. If the pressure in the room drops or rises linearly on the trend overview, the fan runs at approximately the same value at the same time, while the RZ on the exhaust shows proper operation, it is possible that there is a physical blockage in the duct, drive failure or drive failure so the drive spins idle and everything looks good on the system. It is also possible that everything is working properly, but someone has disconnected the pressure tube from the space and the measurement shows the pressure of the reference space. In any case, it is necessary to go out on the field and perform a control measurement and inspection prior to replacing the part.

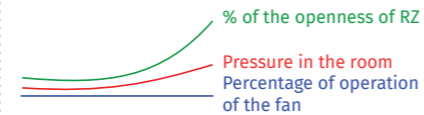


Figure 6. Trend display on the BMS system in case of failure on the exhaust part of the system

Alarm: Temperature / relative humidity of the room is outside the alarm limits

Possible operating errors:

- a) not enough air changes in the room
- b) improper operation of the valve on the heat exchanger line
- c) additional possibilities
- d) no cooling or heating medium (we will exclude this as it is mentioned that this is the first thing that the user has to check before reporting the malfunction).

Possible solution when analyzing a malfunction:

- a) not enough air changes in the room:

I. Static pressure trend on the supply duct and the percentage of fan operation should be reviewed. This can quickly confirm whether the basic parameters have been violated, and after that it is necessary to perform confirmatory measurements in the field.

- b) improper operation of the valve on the heat exchanger line (see Figure 7):

I. The valve drive does the job, but the valve body is stuck. Although the automatic operation is correct, the valve is in the same position at all times. It is necessary to determine the real situation by going out on the field.

II. It is possible that a fault has occurred in the heating or cooling station, so we do not have media that can transfer or take over the heat. This can be checked by reviewing the trend, reading on thermometers or reviewing with a thermal camera. If there is no other way, it can be checked by feeling the heat (using hand is often the fastest way to see results).

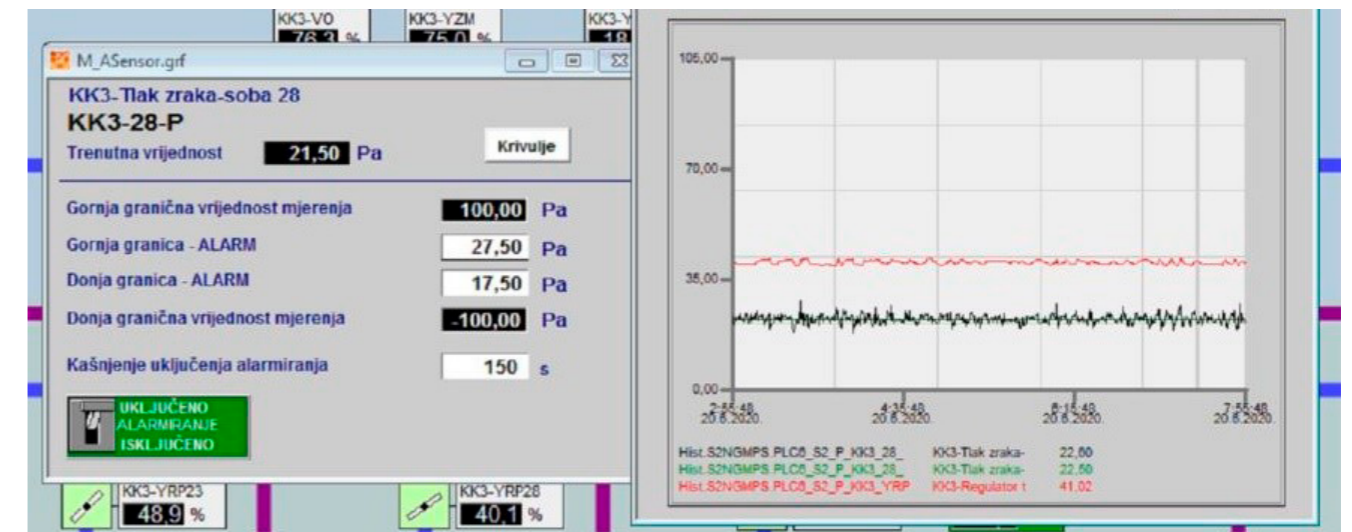


Figure 3. Display of pressure sensor and control valve for one room

Slika 3. Prikaz senzora tlaka i regulatorne zaklopke za jednu prostoriju

IV. Dokaz je manje količine na dobavi mjerenje balometrom u čistom prostoru ili Pitot-cijevi na dobavnom kanalu.

V. Ako nemamo diferencijalni preostat na svakom filteru, potrebno je periodično mjeriti pad tlaka na filterima. Ovo može poslužiti i kao finalni dokaz zaprljanja prije mijenjanja.

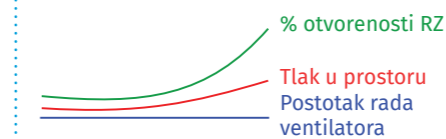
- b) nedovoljno zraka na dobavnoj strani sustava – kvar na regulatoru (RKP, RVP):

I. Ako tlak u prostoru pada ili raste linearno na pregledu trenda, a ventilator u istom vremenu radi na otprilike jednakoj vrijednosti, moguće je da je došlo do fizičkog zastoja u kanalu, kvara pogona ili je netko odspojio cjevčicu na RVP pogonu. U svakom slučaju potrebno je izići na teren i obaviti kontrolno mjerenje i pregled prije zamjene dijela.

- c) kvar na odsisnom dijelu sustava (vidi sliku 6):

I. Ako tlak u prostoru pada ili raste linearno na pregledu trenda, ventilator u istom vremenu radi na otprilike jednakoj vrijednosti, dok RZ na odsisu pokazuje pravilan rad, moguće je da je došlo do fizičkog zastoja u kanalu, kvara pogona ili se pogon odspojio pa se pogon vrti uprazno i na sustavu sve izgleda dobro. Moguće je i da sve radi ispravno, ali je netko odspojio cjevčicu tlaka iz prostora te mjerenje pokazuje tlak referentnog prostora. U svakom slučaju potrebno je izići na teren i obaviti

kontrolno mjerenje i pregled prije zamjene dijela.



Slika 6. Prikaz trenda na BMS sustavu prilikom kvara na odsisnom dijelu sustava

Alarm: Temperatura / relativna vlaga prostora izvan je alarmnih granica

Moguće greške u radu:

- a) nema dovoljno izmjena zraka u prostoru
- b) neispravan rad ventila na cjevovodu izmjenjivača topline
- c) dodatne mogućnosti
- d) nema rashladnog ili ogrjevnog medija (ovo ćemo anulirati jer je spomenuto prva stvar koju korisnik mora provjeriti prije prijave kvara).

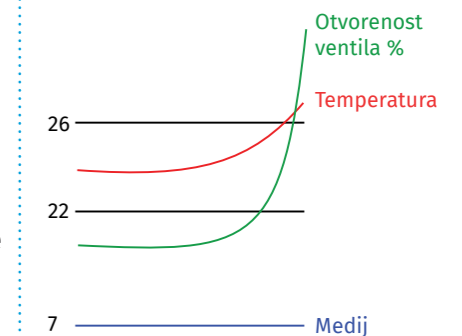
Moguće rješenje prilikom analize kvara:

- a) nema dovoljno izmjena zraka u prostoru:
 - I. Treba pregledati trend statičkog tlaka na dobavnom kanalu i postotak rada ventilatora. Ovo može brzo potvrditi jesu li narušeni osnovni parametri, a nakon toga potrebno je obaviti potvrđna mjerenja na terenu.

- b) neispravan rad ventila na cjevovodu izmjenjivača topline (vidi sliku 7):

I. Pogon ventila odrađuje posao, ali je tijelo ventila zapelo. Iako na automatski javlja ispravan rad, ventil je cijelo vrijeme u istom položaju. Potrebno je izlaskom na teren utvrditi stvarno stanje.

II. Moguće je da je u toplinskoj ili rashladnoj stanici došlo do kvara pa nemamo medija koji omogućuju predaju ili preuzimanje topline. Ovo je moguće provjeriti pregledom trenda, očitanjem na termometrima ili pregledom termo kamerom. Ako nema drugog načina, može se provjeriti osjetom topline (rukom se često najbrže vide rezultati).



Slika 7. Prikaz trenda na BMS sustavu prilikom kvara ventila

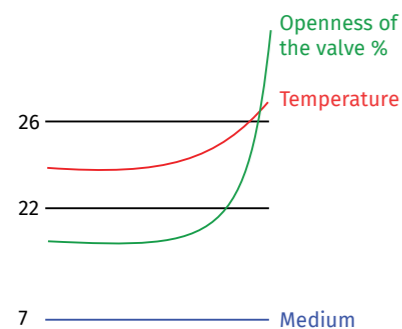


Figure 7. Trend display on the BMS system during valve failure

c) Additional possibilities:

I. It is possible that seemingly everything is fine; the drive and valve body work as well as the pump, the medium is present but the flow is impaired. This often cannot be seen on trend, but it is possible to see if the temperature difference at the flow and return lines is too small. Another way is to examine the barometer to see what the pressure is in the pipeline on the supply and return line. Often the above can be compared to a nearby heat exchanger. If the values deviate greatly, a conclusi-

on can easily be drawn. The problem can occur due to clogging of the slats on the outside (less air flow over the surface of the slats) or clogging on the dirt trap (often occurs after commissioning because all debris in the pipes is found in the dirt trap after a while). II. In addition to the above possibilities, at the beginning of operation it is possible to find that the heat exchanger, in the coldest or warmest days of the year, cannot meet the needs even at 100% operation. It is a lack of heat or cooling capacity. There are no problems with temperature (unless there is a consumer in the room with a large dissipation of heat that is not taken into account), but with the maintenance of relative humidity. On the warmest days of the year, it is necessary to cool the external air extremely, in order to maintain the relative humidity within narrower limits.

Benefits of trend analysis on the BMS system

It is unquestionable whether we benefit from trend analysis on the

BMS interface. Although sometimes it is not enough for a complete conclusion, after the analysis it is possible to advise the user how to check more details before leaving the service center. If we are not sure about the problem, an additional check can narrow it down to two, three possibilities. For large systems, it helps to know that after checking, a service technician with two possible spare parts must be sent to the field. After some time, users themselves recognize the advantages of working with this tool and some order periodic inspections in maintenance in order to be prepared in time to quickly rectify the malfunction or replace the part until the problem has not yet occurred. All of us who deal with maintenance find it useful to have preventive inspections and periodic replacement of spare parts. This reduces unplanned and urgent corrective actions that are much more expensive due to unplanned downtime and lack of reserved resources. Of course, they also cause stress at work which we are not in lack of in these times.

c) dodatne mogućnosti:

I. Moguće je da je naizgled sve u redu; pogon i tijelo ventila rade, kao i pumpa, medij je prisutan, ali je protok oslabljen. Ovo se često ne može vidjeti na trendu, ali je moguće vidjeti ako je premala razlika temperature na polaznom i povratnom vodu. Drugi je način pregledom barometra uvidjeti koliki je tlak u cjevovodu na polaznom i povratnom vodu. Često se spomenuto može usporediti s nekim izmjenjivačem topline u blizini. Ako vrijednosti jako odstupaju, lako se može donijeti zaključak. Problem može nastati zbog začepjenja lamela s vanjske strane (manje prestrujavanje zraka preko površine lamela) ili začepjenja na hvataču nečistoća (često se dogodi nakon puštanja u pogon jer se svi ostatci u cijevima nakon nekog vremena nađu u hvataču nečistoća).

II. Osim navedenih mogućnosti, u početku eksploatacije moguće je otkriti da izmjenjivač, u najhladnijim ili najtoplijim danima u godini, ne može zadovoljiti potrebe niti pri 100 % rada. Radi se o nedostatku toplinskog ili rashladnog

kapaciteta. Ne događaju se problemi s temperaturom (osim ako je u prostoru potrošač s velikom disipacijom topline koja nije uzeta u obzir), već s održavanjem relativne vlage. U najtoplijim danima u godini potrebno je izuzetno hladiti vanjski zrak, kako bi se održavala relativna vlaga u užim granicama.

Koristi analize trendova na BMS sustavu

Neupitno je imamo li koristi od analize trendova na BMS sučelju. Iako ponekad nije dovoljna za potpuni zaključak, nakon analize moguće je korisniku savjetovati kako provjeriti još detalja prije izlaska servisera. Ako već nismo sigurni u problem, dodatnom se provjerom mogućnosti mogu suziti na dvije, tri. Kod velikih sustava pomaže znati da se nakon provjere na teren mora poslati servisera s moguća dva rezervna dijela. Nakon nekog vremena korisnici sami prepoznaju prednosti rada ovim alatom te poneki odrede periodične preglede u održavanju kako bi na vrijeme bili pripremni brzo ot-

kloniti kvar ili zamijeniti doknadni dio dok do problema još nije došlo. Svi mi koji se bavimo održavanjem, smatramo korisnima preventivne preglede i periodične zamjene rezervnih dijelova. Ovim se smanjuju neplanirane i hitne korektivne radnje koje su puno skuplje zbog neplaniranih zastoja u radu i neposjedovanja rezerviranih resursa. Naravno, uzrokuju i stres u poslu koji u ovo vrijeme ne nedostaje.

IN GOOD TIMES AND BAD TIMES

U DOBRU I U ZLU S VAMA

Doria Štibić

HVAC Sales

Despite the hardship caused by the pandemic, earthquakes and the novel corona crisis, we are happy to say that the sales department and Klimaoprema as a whole have successfully coped with the problems that have affected most companies, not only in Croatia but on a global scale as well. Through daily contacts with designers, existing and prospective buyers and investors, we have tried, and hopefully succeeded, to maintain regular business and successfully overcome many of the problems we have encountered. It is in this situation that our team has demonstrated high commitment and performance, that has obviously been recognized and we have consequently begun collaboration with a number of new customers, both in Croatia and in Europe.

In the whole situation, in addition to maintaining production and continuity of deliveries, it was a priority for us to take care of the health of our employees, as well as the employees of our partners with whom we have been in touch. It is for this reason that most of the departments in the company,

including the sales department, worked remotely from home, by which we demonstrated our social responsibility by adhering to the measures prescribed by the competent authorities.

We are also proud to say that the crisis headquarters of Klimaoprema was established, which has been keeping up with the situation unfolding and bringing reasonable decisions at daily meetings that have significantly contributed to success of maintaining regular business and health of our employees, customers and suppliers of our company.

Working from home is very different from working in offices because the line between business and private part during the day is almost erased. Working from home means that there are simply no working hours. One gets to work as much as needed and more, as once simple things, such as organizing international or intercity transportation, requires additional engagement. As we could not leave our homes at that time, I can freely say that our job was an occupation that helped us distract from negative thoughts.

During the period when no sales employee could come to their office, when we were dislocated, limited by both documentation and

information, the main goal was to remain a reliable partner and that our customers do not feel the lack of quality service.

Instead of coffee before work, when the work day is usually organized, today's popular online meetings have become our reality. Although we started and ended our working days at home, this did not prevent us from communicating on a daily basis, exchanging information and news, and staying motivated despite all the challenges that had arisen earlier this year.

Mutually motivating colleagues was also an important task that our leaders did not forsake, given the difficulty of nourishing positive thoughts and attitudes.

We are very proud that, despite the unfavorable economic situation, in which many companies have encountered hardship in business, we have maintained the trust of our regular customers and gained the trust of new ones.

We hope that our vision of future business will keep moving forward, that we are going to overcome a new possible crisis and that we will be cooperating and maintaining business at a level that meets both the needs of Klimaoprema and the needs of customers who count on us.



Usprkos nevoljama uzrokovanim pandemijom, potresima i novonastalom korona krizom, sretni smo što možemo reći kako su se prodajni odjel i ostatak tvrtke Klimaoprema uspješno nosili s problemima koji su zahvatili većinu tvrtki, ne samo u Hrvatskoj, nego u gotovo cijelom svijetu.

Svakodnevnim kontaktima s projektantima, postojećim i potencijalnim kupcima i investitorima, pokušali smo, i nadamo se u tome uspjeli, održati uredno poslovanje i uspješno premostiti brojne probleme na koje smo nailazili. U ovakvoj situaciji prepoznat je trud i kvaliteta u radu našeg tima, što pokazuje i velik broj novih kupaca s kojima smo započeli suradnju, kako u Hrvatskoj, tako i u Europi. U cijeloj situaciji, uz održanje proizvodnje i neprekidnosti isporuka, bilo nam je važno brinuti se o zdravlju naših zaposlenika, kao i djelatnika naših partnera s kojima smo bili u kontaktu. Zbog toga je većina odjela u tvrtki, kao i prodajni odjel, radila od kuće, čime smo pokazali i društvenu odgovornost držeći se mjera koje su propisala nadležna tijela.

Također, ponosni smo reći kako je

osnovan krizni stožer Klimaoprema koji je, prateći razvoj situacije, na svakodnevnim sastancima donosio mudre odluke koje su značajno pridonijele uspjehu očuvanja urednog poslovanja kao i zdravlja naših djelatnika, ali i djelatnika kupaca i dobavljača naše tvrtke. Rad od kuće uvelike se razlikuje od rada u uredu jer je gotovo izbrisana granica između poslovnog i privatnog dijela tijekom dana. Rad od kuće podrazumijeva da radnog vremena jednostavno nema. Radi se koliko je potrebno i više, stoga što su mnogobrojne, nekada jednostavne stvari, poput organiziranja međunarodnog ili međugradskog prijevoza, zahtijevale dodatni angažman. Kako u to vrijeme nismo mogli izlaziti iz kuće, mogu slobodno reći da nam je posao bio zanimacija koja je pomogla osloboditi se loših misli.

U periodu kada nijedan zaposlenik prodaje nije mogao doći u svoj ured, kada smo bili dislocirani, ograničeni i dokumentacijom i informacijama, glavni cilj bio je ostati pouzdan partner te da naši kupci ne osjete nedostatak kvalitetne usluge.

Umjesto kave prije posla, kada se

najčešće organizira tijekom radnog dana, danas popularni mrežni sastanci postali su nam svakodnevica. Iako smo radne dane počinjali i završavali u kući, to nas nije spriječilo da svakodnevno komuniciramo, izmjenjujemo informacije i novosti te ostanemo motivirani usprkos svim problemima koji su se pojavili početkom ove godine. Međusobno motiviranje kolega također je bio važan zadatak koji naši voditelji nisu zaboravili, s obzirom na teškoću zadržavanja pozitivnih misli i stava.

Vrlo smo ponosni što smo, usprkos lošoj gospodarskoj situaciji, u kojoj se dosta poduzeća susrelo s problemima u poslovanju, zadržali povjerenje naših stalnih kupaca i pridobili povjerenje novih. Nadamo se da će naša vizija budućeg poslovanja nastaviti naprijed, da ćemo nadići i novu moguću krizu te da ćemo i dalje surađivati i održavati poslovanje na razini koja zadovoljava, kako potrebe tvrtke Klimaoprema, tako i potrebe kupaca koji računaju na nas.



LAMINAR DEVICE FOR THE POWDER METALLURGY LABORATORY AT THE FSB

LAMINARNI ZAŠTITNI UREĐAJ ZA ODJEL METALURGIJE NA FSB-U

Ph.D Tamara Aleksandrov Fabijanić

Faculty of Mechanical Engineering and Naval Architecture

Introduce your department and what you do.

The Powder Metallurgy Laboratory at the Faculty of Mechanical Engineering and Naval Architecture was established in 2019 as part of and with the funds of the founding research project of the Croatian Science Foundation called Nanostructured Hardmetals - New Challenges for Powder Metallurgy (NANO-PM). Its reference number is HRZZ-UIP-2017-05-6538, and the project leader is Tamara Aleksandrov Fabijanić, PhD. Powder metallurgy in Europe is one of the key drivers of development and its application in various industries generates an annual turnover of goods and services worth about twenty billion euros. It is crucial in the production of tools and equipment with unique properties, high quality and superior features. In European countries, there are some of the most important companies and research institutions that apply powder metallurgy in production, and therefore represent key suppliers to industries (automotive, aerospace and construction) that use hard metal products in their own growth and development. Of the total production of hard metal products in Europe, between 70 and 80% of the products are used in the automotive industry. The field of application is expanding with the application of powders of smaller and smaller grain size, as well as with the progress of technology and consolidation procedures, especially with the increase in the application of additive technologies that rely on powder as a star-

ting material.

The recently established Powder Metallurgy Laboratory is equipped with state-of-the-art research equipment (horizontal ball mill, vacuum distillation device, ultrasonic bath, magnetic stirrer, precision scale for determining density, sieve for granulation of powders and mixtures, probe for flow measurement, transmission potentiostat and indenter with scratch test) deployed in the development of materials obtained by powder metallurgy, which places it alongside the world's research laboratories.

Other than research activities of the HRZZ project, the Powder Metallurgy Laboratory also carries out activities of the Research and Development of Nanostructured Hardmetals for the Development of New Products (NANO-PRO) project. Its reference number is KK.01.2.1.01.0079. It is financed by the European Structural and Investment Fund, within the Operational Program Competitiveness and Cohesion 2014-2020, carried out by the Powder Metallurgy Laboratory in cooperation with company Alfa tim d.o.o. from Zagreb.

The primary goal and activity of the Powder Metallurgy Laboratory

are focused on the development of new, innovative materials and products made of hard metal, competitive on the domestic and world markets.

How did you find out about Klimaoprema and our products?

Company Klimaoprema has a record of a successful, long-term cooperation with the Faculty of Mechanical Engineering and Naval Architecture, joint participation in scientific research and development projects and student scholarships. It also employs a large number of Masters of Engineering and Masters of Engineering and is highly regarded in academia and engineering circles.

For what purposes do you use our laminar device and how does it help you in your daily work?

In the Powder Metallurgy Laboratory powder mixtures are prepared by combining ultrafine and nanopowder particles, tungsten carbide grain size WC 200 nm and varying the proportion and type of matrix; Co, Ni, Fe. The laminar



Sink and sink from our range of stainless steel furniture products
Sudoper i korito iz naše palete proizvoda inox namještaja



Cabinet KTB-NS installed and ready for use
Kabinet KTB-NS instaliran i spreman za uporabu

Predstavite svoj odjel i čime se bavite.

Laboratorij za metalurgiju praha, Fakulteta strojarstva i brodogradnje, uspostavljen je 2019. godine u sklopu i sa sredstvima uspostavnog istraživačkog projekta Hrvatske zaklade za znanost pod nazivom Nanostrukturirani tvrdi metali – Novi izazovi metalurgije praha (NANO-PM). Oznaka mu je HRZZ-UIP-2017-05-6538, a voditeljica projekta je dr. sc. Tamara Aleksandrov Fabijanić. Metalurgija praha na području Europe jedan je od ključnih pokretača razvoja i njezina primjena u različitim granama industrije generira godišnji promet dobara i usluga vrijedan oko dvadeset milijarda eura. Ključna je u proizvodnji alata i opreme s jedinstvenim svojstvima, visoke kvalitete i vrhunskih karakteristika. U europskim zemljama nalaze se neke od najvažnijih tvrtaka i istraživačkih institucija koje metalurgiju praha primjenjuju u proizvodnji, stoga predstavljaju ključne opskrbljivače industrija

(automobilske, zrakoplovne i građevinske) koje tvrdometalne proizvode koriste u vlastitom rastu i razvoju. Od ukupne proizvodnje tvrdometalnih proizvoda u Europi, između 70 i 80% proizvoda koristi se u automobilske industriji. Područje primjene širi se primjenom prahova sve manje veličine zrna, kao i napretkom tehnologije i postupaka konsolidacije, posebice porastom primjene aditivnih tehnologija koje kao polazni materijal koriste prah.

Novouspostavljeni Laboratorij za metalurgiju praha opremljen je najsuvremenijom istraživačkom opremom (horizontalnim kugličnim mlinom, uređajem za vakuumsku destilaciju, ultrazvučnom kupelji, magnetskom miješalicom, preciznom vagom za određivanje gustoće, sitom za granulaciju prahova i mješavina, sondom za mjerenje protoka praha, prijenosnim potencijostatom te indenterom sa scratch testom) koja se koristi u razvoju materijala dobivenih metalurgijom praha, što ga svrstava

uz bok svjetskih istraživačkih laboratorija.

Osim istraživačkih aktivnosti HRZZ projekta, u Laboratoriju za metalurgiju praha provode se i aktivnosti projekta Istraživanje i razvoj nanostrukturiranih tvrdih metala za razvoj novih proizvoda (NANO-PRO). Oznaka mu je KK.01.2.1.01.0079. Financira ga Europski strukturni i investicijski fond, u okviru Operativnog programa Konkurentnost i kohezija 2014. – 2020., koji Laboratorij za metalurgiju praha provodi u suradnji s tvrtkom Alfa tim d. o. o. iz Zagreba. Primarni cilj i djelatnost Laboratorija za metalurgiju praha orijentirani su na razvoj novih, inovativnih materijala i proizvoda od tvrdog metala, konkurentnih na domaćem i svjetskom tržištu.

Kako ste doznali za Klimaopremu i naše proizvode?

Tvrtka Klimaoprema bilježi uspješnu, dugogodišnju suradnju s Fakultetom strojarstva i brodogradnje, zajedničkim sudjelovanjem na znanstvenoistraživačkim i razvojnim projektima te stipendiranjem studenata. Također, zapošljava velik broj magistara inženjera i magistra inženjeraka te je vrlo cijenjena u akademskoj zajednici i inženjerskim krugovima.

U koje svrhe koristite naš laminarni uređaj i kako vam pomaže u svakodnevnom radu?

U Laboratoriju za metalurgiju praha pripremaju se mješavine prahova kombinacijom ultrafinih i nano čestica praha, veličine zrna volfram karbida WC 200 nm i variranjem udjela i vrste matrice; Co, Ni, Fe. Laminarni uređaj (mikrobiološki zaštitni kabinet) koristi se prilikom pripreme polaznih mješavina, istovremeno štiteći operatera i polazne prahove. Ultrafine i nano čestice praha vrlo su reaktivne. Nepravilno rukovanje i skladištenje lako može uzrokovati oksidaciju praha, što u konačnici

device (microbiological protection cabinet) is used during the preparation of starting mixtures, at the same time protecting the operator and starting powders. Ultrafine and nanopowder particles are highly reactive. Improper handling and storage can easily cause oxidation of the powder, which ultimately affects the microstructural characteristics and mechanical properties of the finished products. The microbiological protection cabinet has a supply of protective nitrogen gas, which we use to protect the powders from oxidation. Also, it is very important that the atmosphere in which the mixtures are prepared is clean, so as not to contaminate the mixture, which is what air filters enable. Last but by no means least, the microbiological protection cabinet serves the operator as protection against inhalation of nanoparticles. One of the components we use in the development of new materials is cobalt (Co) powder, which the World Health Organization has classified as a group of carcinogenic and genotoxic materials. Recent research confirms that the interaction between Co and WC is even more toxic and can cause lung disease. For these reasons, the cabinet helps us in handling the powder greatly.

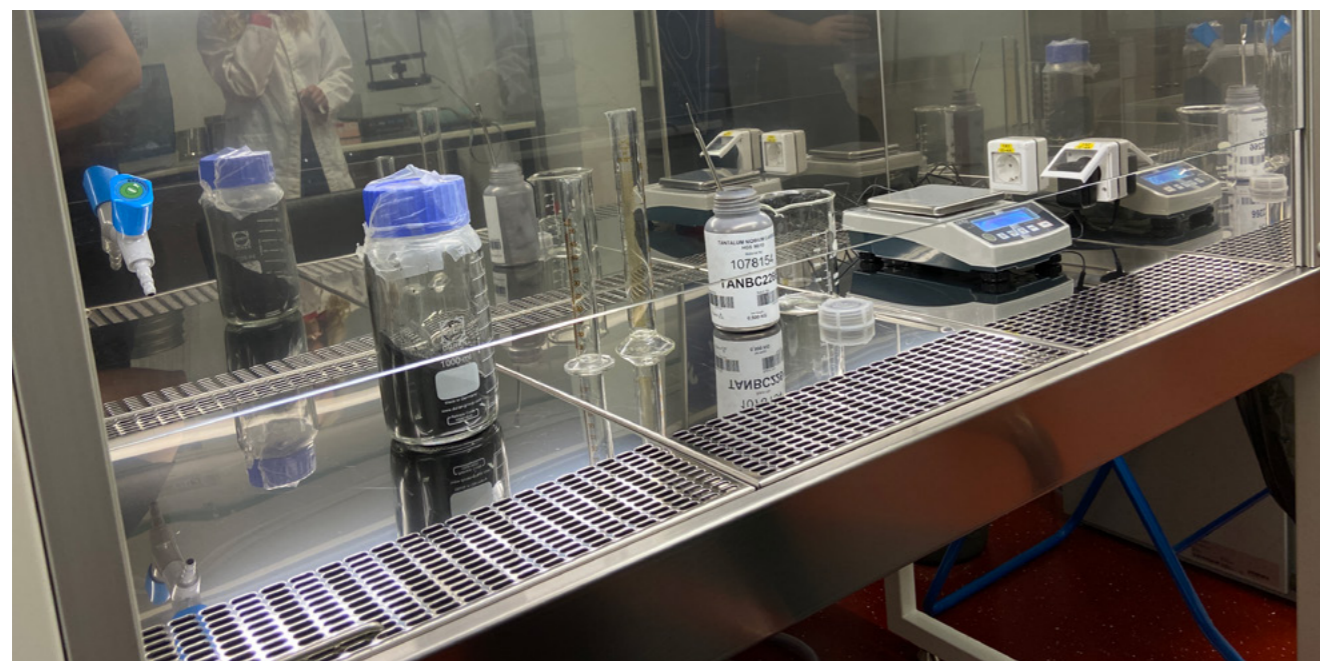
Laminator KTB-NS II is custom-made to meet our requirements, has a duct for exhaust air and ultraviolet radiation that allows us to sterilize laboratory utensils before and after being utilized and ensures the purity of the technological process of obtaining new materials, which reflects on the superior mechanical properties of finished products.

What are your experiences in using our equipment?

We are extremely satisfied with the delivered equipment. The microbiological protection cabinet is very simple and intuitive to use, owing to the digital display by which we control the device with a touch of a finger. Due to its unique, minimalist design, the microbiological protection cabinet is very easy to maintain and clean. Work surfaces are flat, made of stainless steel and do not have grooves into which powder particles could potentially be crept in. The cabinet has an electricity connection which allows us to weigh powders and prepare mixtures while protecting the operator, which is necessary for the above mentioned reasons.

Is the laminar device used by other departments and students for their work as well?

The equipment in the Powder Metallurgy Laboratory is available to all employees under the supervision of laboratory staff or with prior training in handling. Since this is a new research area and new equipment, the activities of the Powder Metallurgy Laboratory include senior students in the preparation of graduate theses, whereby they use the microbiological protection cabinet. As part of the course Powder Metallurgy, students enrolled at Material Science and Engineering have the opportunity to get acquainted with the first phase of the technological process of powder metallurgy, which relates to the preparation of starting mixtures. I believe that in the future, with further development of the research area and the expansion of research activities to other groups of materials obtained by powder metallurgy, more researchers and students will be deploying the equipment of the Powder Metallurgy Laboratory, including the microbiological protection cabinet as well.



KTB-NS workspace in use | KTB-NS radni prostor u upotrebi



Photo from the opening of the laboratory | Fotografija s otvorenja laboratorija

ci utječe na mikrostrukturne karakteristike i mehanička svojstva gotovih proizvoda. Mikrobiološki zaštitni kabinet posjeduje dovod zaštitnog plina dušika, koji koristimo kako bismo prahove zaštitili od oksidacije. Također, vrlo je važno da atmosfera u kojoj pripremamo mješavine bude čista, kako ne bi došlo do kontaminacije mješavine, što nam omogućavaju filteri zraka. Posljednje, ali nikako posljednje po važnosti, mikrobiološki zaštitni kabinet operateru služi kao zaštita od udisanja nano čestica. Jedna od komponenata koje koristimo u razvoju novih materijala je i prah kobalta (Co) koji je Svjetska zdravstvena organizacija svrstala u skupinu kancerogenih i genotoksičnih materijala. Novija istraživanja potvrđuju da je interakcija između Co i WC još toksičnija i može uzrokovati bolest pluća. Iz navedenih razloga kabinet nam uvelike pomaže pri rukovanju prahom. Laminarni uređaj KTB-NS II posebno je konstruiran na temelju naših potreba, posjeduje kanal za odvod odrađenog zraka te ultraljubičasto zračenje koje nam omogućava sterilizaciju laboratorijskog posuđa prije i nakon korištenja te osigura-

va čistoću tehnološkog postupka dobivanja novih materijala, što se odražava na superiorna mehanička svojstva gotovih proizvoda.

Kakva su vaša iskustva u korištenju naše opreme?

Izuzetno smo zadovoljni isporučenom opremom. Mikrobiološki zaštitni kabinet vrlo je jednostavan i intuitivan za korištenje, zahvaljujući digitalnom zaslonu pomoću kojeg pritiskom prsta upravljamo uređajem. Zbog jedinstvenog, minimalističkog dizajna, mikrobiološki zaštitni kabinet vrlo je jednostavan za održavanje i čišćenje. Radne plohe su ravne, izrađene od nehrđajućeg čelika i ne posjeduju utore u koje bi se potencijalno mogle zavući čestice praha. Kabinet posjeduje priključak za struju što nam omogućava vaganje prahova i pripremu mješavina uz istovremenu zaštitu operatera koja je nužna iz prethodno navedenih razloga.

studenti laminarni uređaj za svoje radove?

Oprema u Laboratoriju za metalurgiju praha na raspolaganju je svim djelatnicima uz nadzor osoblja laboratorija ili uz prethodno osposobljavanje za rukovanje. Budući da je riječ o novom istraživačkom području i novoj opremi, u aktivnosti Laboratorija za metalurgiju praha uključeni su studenti viših godina prilikom izrade diplomskih radova, pri čemu koriste mikrobiološki zaštitni kabinet. U sklopu kolegija Metalurgija praha, studenti smjera Inženjerstvo materijala imaju priliku upoznati prvu fazu tehnološkog procesa metalurgije praha koja se odnosi na pripremu polaznih mješavina. Vjerujem da će se u budućnosti, daljnjim razvojem istraživačkog područja i širenjem istraživačkih aktivnosti na druge skupine materijala dobivenih metalurgijom praha, veći broj istraživača i studenata u radu koristiti opremom Laboratorija za metalurgiju praha, uključujući i mikrobiološki zaštitni kabinet.

Koriste li ostali odjeli i

HUMAN RESOURCES DEVELOPMENT IN KLIMAOPREMA

RAZVOJ LJUDSKIH POTENCIJALA U KLIMAOPREMI

Nataša Batur

Head of Human resources

Klimaoprema takes care of the development, advancement and personal well-being of its employees

The Human Resources Department was established in 2016. Since the creation of the department, we have believed in the potential of our employees. We have decided to always value and appreciate our employees and to be primarily – human. And as all humans, our employees, Human Resources Department and the Management Board, sometimes make mistakes, too, but we tend to improve and evolve, and the effort itself represents the development of potential.

Human Resources Management

In this issue let us look back to where we have been, present where we are at this point, and where we are heading to with future plans of the Human Resources Department that moves ahead together with the rest of Klimaoprema. At the beginning of our work, in 2016, Klimaoprema employed 285 employees, and today it numbers 480 employees, with steady growth and expansion prospects. The first task was to establish basic human resource management processes, which required clear and stable procedures, training of all managers on their implementation and compliance with ISO quality standards certificates, due to which our processes regularly and successfully meet various audits. We started by analyzing jobs, made the first organizational structure and descriptions, and today we are already on an extensive

upgrade of the mentioned process and we are looking forward to new jobs, additions to existing and even more precise and concise descriptions, which are going to facilitate our existing and future employees in managing every day and long-term tasks at their workplace.

Employee Onboarding

We have formalized the recruitment process, but also made it more flexible. Different requirements and diversity of jobs that Klimaoprema offers require several ways of searching, selecting and recruiting the best candidates and new colleagues. There is an active system of rules for the selection process that ensures obje-

ctivity, timeliness and transparency in time efficient manner that do not hinder opportunities for prompt action in an increasingly competitive labor market. We also rely on modern tools and support of our partners - portal MojPosao and software TalentLyft.

For each new employee there is an onboarding process, tailored to the job requirements and the necessary level of knowledge, which includes on-the-job training, a minimum of one month, and mentoring, a maximum of six months. There are big plans ahead of us for an even more detailed and personalized elaboration of this process, so that each employee receives the most adequate professional and friendly assistance when taking on a new job.



Klimaoprema se brine o razvoju, napretku, usavršavanju te osobnoj dobrobiti svojih djelatnika

Odjel za ljudske potencijale nastao je 2016. godine. Od nastanka odjela, svoje zaposlenike nazivamo i smatramo potencijalima, a ne resursima. Odlučili smo uvijek vrednovati i cijeniti svoje djelatnike te prema svakome, prije svega, biti čovjek. Kao i svi ljudi, naši potencijali, Odjel za ljudske potencijale i uprava, ponekad griješe, ali trudimo se popravljati i napredovati, a trud sam po sebi predstavlja razvoj potencijala.

Upravljanje ljudskim potencijalima

Ovim izdanjem predstavljamo dosadašnji put, trenutno stanje i buduće planove Odjela za ljudske potencijale, koji se razvija zajedno s ostatkom Klimaopreme. U vrijeme početaka našeg rada, 2016. godine, Klimaoprema je zapošljavala 285 djelatnika, a danas

ih ima 480, s daljnjim, konstantnim rastom.

Prvi zadatak bio je uspostaviti osnovne procese upravljanja ljudskim potencijalima, koji su zahtijevali jasne i stabilne procedure, obuku svih voditelja o njihovom provođenju te usklađenost s certifikatima ISO standarda kvalitete, zbog kojih naši procesi redovno i uspješno zadovoljavaju različite audite. Krenuli smo analizirajući radna mjesta, napravili prvu organizacijsku strukturu i opise, a danas smo već na opsežnoj nadogradnji spomenutog procesa te se veselimo novim radnim mjestima, nadopunama postojećih te još preciznijim i konciznijim opisima, koji će postojećim i budućim djelatnicima omogućiti lakše snalaženje u svakodnevnim i dugoročnim zadacima njihova radnog mjesta.

Uvođenje u posao

Proces zapošljavanja smo formalizirali, ali i fleksibilizirali. Različiti zahtjevi i raznolikost radnih mjesta, koje Klimaoprema nudi,

iziskuju nekoliko načina potrage, selekcije i odabira najboljih kandidata i novih kolega. Aktivan je sustav pravila selekcijskog procesa koji osigurava objektivnost, pravovremenost i transparentnost, a istovremeno ne guši vrijeme i mogućnosti brzog djelovanja na sve konkurentnijem tržištu rada. Koristimo i pomoć modernih alata te podršku naših partnera – portala MojPosao i softvera TalentLyft.

Za svakog novog djelatnika postoji proces uvođenja u posao, prilagođen potrebama posla i nužnoj razini znanja, koji obuhvaća osposobljavanje za radno mjesto, minimalno mjesec dana, te mentorstvo, maksimalno šest mjeseci. Veliki su planovi pred nama za još detaljniju i personaliziraniju razradu ovog procesa, kako bi svaki djelatnik dobio što adekvatniju stručnu i prijateljsku pomoć pri dolasku na novo radno mjesto.

Interna akademija Klimaopreme

Uveli smo sustavno praćenje edukacija izvještajima i zapisima koji nam pomažu utvrditi zadovoljstvo djelatnika vanjskim pružateljima edukacijskih usluga, a pomogli su nam uvidjeti i povećanu potrebu za međusobnim internim edukacijama. Navedeno je dovelo do novog projekta u obliku interne akademije, odnosno Edukacijskog centra znanja Klimaopreme, koji će unaprijediti, centralizirati i uspostaviti znanje svakog djelatnika te omogućiti čuvanje i vrednovanje znanja kao našeg najvećeg blaga.

Sinergija Klimaopreme i znanstveno-obrazovne zajednice

S obzirom na to da je primarni aspekt poslovanja naše tvrtke proizvodno-tehnološki, trudimo se raditi na sinergiji Klimaopreme i znanstveno-obrazovne zajednice te vrlo rado sudjelujemo u raznim projektima pružajući podršku mladim budućim stručnjacima, koji često i sami postaju dio našeg radnog tima.

Svake nas godine možete pronaći na Danima karijera Fakulteta stro-



Internal Academy of Klimaoprema

We have introduced systematic monitoring of education with reports and records that help us determine the satisfaction of employees with external providers of education services, and they have helped us see the increased need for mutual internal trainings. This has led to a new project in the form of an internal academy, or Klimaoprema Education Knowledge Center, which will improve, centralize and systematize the knowledge of each employee and enable the preservation and valuing of knowledge as our greatest treasure.

Synergy of Klimaoprema and the scientific-educational community

Given that the primary aspect of our company's business is production and technology, we strive to work on the synergy of Klimaoprema and the scientific and educational community and are very happy to have participated in various projects providing support to young future professionals, who often become part of our work team. Every year you can find us at the Career Days of the Faculty of Mechanical Engineering and Naval Architecture in Zagreb, as well as the Technical Faculty in Rijeka. For students of the Faculty of Mechanical Engineering and Naval Architecture we regularly organize a competition called Innovation and

Creativity, in which we award HRK 7.500 to resourceful students who come up with a solution to a complex task.

We regularly support students of technical faculties in doing professional practice, and we also do this for students of the Industrial and Craft School in Nova Gradiška, who often become our employees in the production plant after the internship and completion of schooling.

Other than local students, we have had the opportunity to host students from France and Italy at our practice.

Care for health of employees and their families

From year to year, we provide additional benefits to our employees, taking care of health, well-being and family. We have been users of Multisport cards for two years now, which enable every interested employee to use numerous sports facilities throughout Croatia at discounted prices. We also organized Klimaoprema Health Day, when nutritionists and coaches demonstrated rules of a healthy lifestyle.

We provide employees with additional health insurance that grants free and detailed systematic examinations and amounts to up to 1.000 kn free specialist and 2.000 kn free diagnostic examinations. Our goal is to encourage togetherness, value family and cultivate friendly relations among colleagues, which is why last year we la-

unched and realized the initiative of the Family Day of Klimaoprema, which was extremely well attended, with cheerful socializing of our employees and their families. We organized competition The Best Employee of Klimaoprema Award for The Best Employee in Croatia Award, in which as many as three employees were awarded the amount of 5.000 kn, in accordance with coworkers' rating.

We keep moving forward...

Klimaoprema has been reaching out in the global market for 45 years, and the Human Resources Department has been operating as a special sector for the last four years. Outstanding shift forward has been made, but we still have a long way to go. The challenges of today's world force us to adapt quickly to new situations, provide support in stressful situations, and to progress and grow faster. We will strategically continue to develop existing processes and introduce new ones, while listening to each of our employees closely. A new project that aims to improve mutual communication among all employees, enable better information flow and more opportunities for employees' voice to be heard, is LjuPKO, a monthly newsletter intended for all our employees. We believe that our efforts will remain recognized and valued, our employees even more satisfied, with their potential developed and valued to the fullest.

jarstva i brodogradnje u Zagrebu, kao i Tehničkog fakulteta u Rijeci. Za studente FSB-a redovito organiziramo natječaj naziva Inovativnost i kreativnost u kojem, domišljatim studentima koji ponude rješenje složenog zadatka, kao nagradu dodijelimo 7.500 kn. Redovito podržavamo studente tehničkih fakulteta pri odrađivanju stručne prakse, a spomenuto činimo i za učenike Industrijsko-obrtničke škole u Novoj Gradiški, koji često nakon odrađene prakse i završetka školovanja postaju naši djelatnici u tamošnjem proizvodnom pogonu. Osim domaćih studenata, na praksi smo imali priliku ugostiti i studente iz Francuske i Italije.

Briga o zdravlju djelatnika i obitelji

Iz godine u godinu osiguravamo dodatne pogodnosti za naše djelatnike, brinući se o zdravlju, dobrobiti i obitelji. Već smo dvije godine korisnici Multisport kartica, koje svakom zainteresiranom djelatniku omogućuju korištenje brojnih sportskih objekata diljem Hrvatske po povlaštenim cijenama. Također smo organizirali Dan

zdravlja Klimaopreme, kad su nutricionisti i treneri pokazali pravila zdravog života.

Djelatnicima pružamo dodatno zdravstveno osiguranje koje omogućava besplatan i detaljan sistematski pregled te iznose do 1.000 kn besplatnih specijalističkih i 2.000 kn besplatnih dijagnostičkih pregleda.

Cilj nam je poticati zajedništvo, vrednovati obitelj i gajiti prijateljske odnose među kolegama, stoga smo prošle godine pokrenuli i ostvarili inicijativu Obiteljskog dana Klimaopreme, koji je bio iznimno posjećen, uz veselo druženje naših djelatnika i njihovih obitelji. Organizirali smo natječaj Naj radnik Klimaopreme za naj radnika Hrvatske, pri kojem je čak troje radnika nagrađeno iznosom od 5.000 kn, u skladu s glasovima kolega.

Nastavljamo dalje...

Klimaoprema uspješno korača svjetskim tržištem već 45 godina, a Odjel za ljudske potencijale kao poseban sektor posluje posljednje četiri godine. Ostvaren je izniman napredak, no dugačak je put još pred nama. Izazovi današnjeg svi-

jeta tjeraju nas na brzu prilagodbu novim situacijama, osiguranje podrške u stresnim situacijama i na brzi napredak i rast. Strateški ćemo i dalje razvijati postojeće procese te uvoditi nove, slušajući pri tome glas svakog našeg zaposlenika.

Novi projekt kojim želimo unaprijediti međusobnu komunikaciju sa svim djelatnicima, pružiti informacije i mogućnost da se čuje i njihov glas, jest LjuPKO (Ljudski potencijali Klimaopreme), mjesečni bilten namijenjen svim našim zaposlenicima.

Vjerujemo da će naš trud ostati prepoznat i vrednovan, naši zaposlenici sve zadovoljniji, a njihovi potencijali maksimalno razvijeni i vrednovani.



NEWS FROM KLIMAOPREMA

VIJESTI IZ KLIMAOPREME



His Excellency Robert Kohorst, United States Ambassador to Croatia, visited Klimaoprema

Veleposlanik Sjedinjenih Američkih Država u Hrvatskoj W. Robert Kohorst posjetio je Klimaopremu



At the HGK awards, we won the Kuna for best business results in 2018 in competition with large companies. We are proud of the award and we are definitely ready for the challenges ahead!

Na dodjeli nagrada hrvatske gospodarske komore (HGK) osvojili smo Zlatnu kunu za najbolje poslovne rezultate u 2018. godini u konkurenciji velikih trgovačkih društava. Ponosni smo na osvojenoj nagradi i svakako smo spremni za nadolazeće izazove!

A small lighthouse for great people

The best workers of Klimaoprema d.d. were awarded a cash prize in the amount of HRK 5.000, and their applications were forwarded to the competition The Best Worker in Croatia 2019.

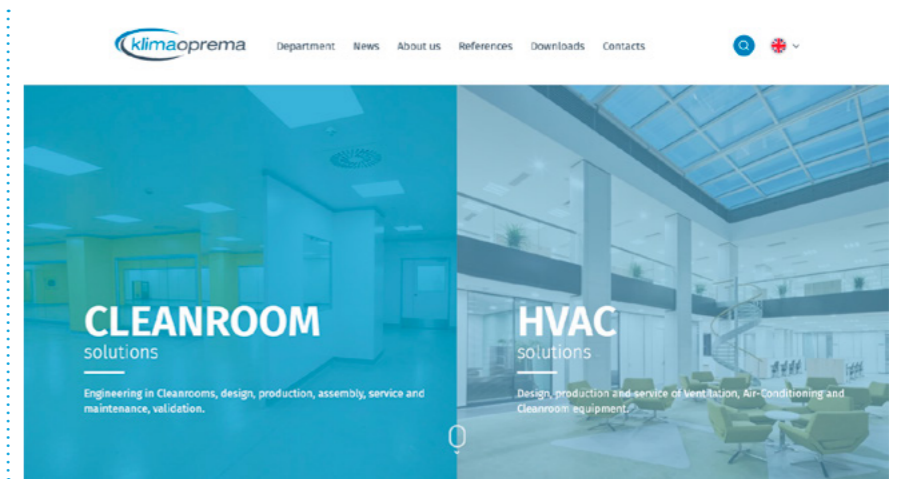
Mali svjetionik za velike ljude

Naj radnici Klimaopreme d.d. su nagrađeni sa novčanom nagradom u iznosu od 5.000,00 kn, te su njihove prijave prosljeđene na natječaj Naj radnik Hrvatske 2019.



At the beginning of the year, we completed the megaproject of website redesign and database implementation of all cleanroom and HVAC products.

Početak godine završili smo megaprojekt redizajna web stranice te implementacije baze podataka svih cleanroom i HVAC proizvoda.



On the occasion of the 100th anniversary of Faculty of Mechanical Engineering and Naval Architecture we have allocated the award for innovative solution on the subject of "autonomous device for tape application inside cylindrical sheath". Compliments to students Martin Jurman, Stefan Jukopila and Filip Koraca on an ingenious idea!

Povodom 100. obljetnice FSB-a dodijelili smo nagradu za inovativno rješenje na temu "Autonomna ćelija za nanošenje trake unutar cilindričnog plašta". Pohvale studentima Martinu Jurmanu, Stefanu Jukopili i Filipu Koraci na genijalnoj ideji!



We participated in the Digital (R) Evolution 3.0 conference! Our director Sergio Galošić proudly explained the new automated process of making panel walls from 3D models to the installation on the building, and how much time and money savings compared to the previous process.

Sudjelovali smo na konferenciji Digitalna (R)evolucija 3.0! Naš direktor Sergio Galošić s ponosom je objasnio novi automatiziran proces izrade panelnih zidova od 3D modela do same montaže na objektu, te kolike su vremenske i novčane uštede u odnosu na prethodni proces.

After nine months of continuous work, the project of implementing the 5S methodology in the production system of Klimaoprema was completed. A total of 520 activities related to 5S were performed, and 32 employees worked diligently on the project at locations in Samobor and Nova Gradiška. The com-

pletion of the project was marked by the distribution of 5S certificates, and the partner in the project was the company Culmena d.o.o.

Nakon devet mjeseci kontinuiranog rada završen je projekt implementacije 5S metodologije u proizvodni sustav Klimaopreme.

Ukupno je odrađeno 520 aktivnosti vezanih uz 5S, a na projektu je marljivo radilo 32 djelatnika na lokacijama u Samoboru i Novoj Gradišci. Završetak projekta obilježen je podjelom 5S certifikata, a partner na projektu bila je tvrtka Culmena d.o.o.



First impression we make on the market is of great importance to us and for this reason we contribute great importance to our certificates. In order to achieve the desired excellence we are accompanied by our new partner - TÜV NORD.

Prvi dojam koji stvaramo na tržištu od velikog je značaja za nas i iz tog razloga dajemo veliku važnost našim certifikatima. Kako bismo postigli željenu izvrsnost, prati nas novi partner - TÜV NORD.

We presented the company at FSB on the occasion of its 100th anniversary. Students had the opportunity to learn all about the opportunities and benefits of practicing internships and future employment.

Predstavili smo tvrtku na FSB-u povodom 100. obljetnice. Studenti su imali priliku naučiti sve o mogućnostima i prednostima odrađivanja prakse i budućeg zapošljavanja.



FAIRS

SAJMOVI

Pharmtech, Moscow 19-22 November 2019

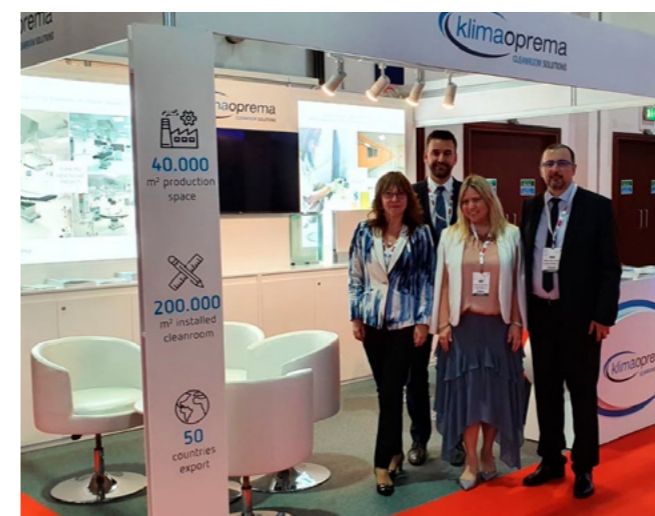
In the period from 19.11. to 22.11.2019 in Moscow was held the 21st in a row fair with the accompanying congress PHARMTECH & Ingredients, focused on the field of pharmaceuticals. As the fair grows from year to year, this time we co-

operated 19.675 m² of exhibition space, 479 exhibitors, and the fair was visited by 8.231 visitors. Klimaoprema exhibited in pavilion 2, hall 8, at stand B7053.

Pharmtech, Moskva 19-22 studeni 2019.

U periodu od 19.11. do 22.11.2019.

u Moskvi održan je 21. po redu sajam s pratećim kongresom PHARMTECH & Ingredients, fokusiran na području farmaceutike. Kako sajam raste iz godine u godinu, ovog puta brojimo 19.675 m² izložbenog prostora, 479 izlagača, a sajam je posjetilo 8.231 posjetilaca. Klimaoprema je izlagala u paviljonu 2, hali 8, na štandu B7053.



Arab Health, Dubai 27-30 January 2020

In the period from 27.01. to 30.01.2020 the Arab Health Fair was held in Dubai, with an accompanying congress. The Arab Health Fair is the largest gathering place for experts in the field of cleanroom and the health industry in the MENA region. With more than 57.000 visitors, 4.142 exhibitors and participants from over 170 countries, technological advances in Middle Eastern healthcare were presented. The Klimaoprema stand was a

place for business meetings with many existing and potential partners. With an office in the United Arab Emirates, Klimaoprema is continuously present on the market and designs, manufactures and delivers cleanroom and HVAC solutions in the Middle East.

Arab Health, Dubai 27-30 sječanj 2020.

U razdoblju od 27.01. do 30.01.2020. u Dubaiju je održan sajam Arab Health, uz prateći kongres. Sajam Arab Health najveće je mjesto okupljanja stručnjaka iz pod-

ručja čistih prostora te zdravstvene industrije u MENA regiji. Sa više od 57.000 posjetitelja, 4.142 izlagača i sudionika iz preko 170 zemalja, prikazan je tehnološki napredak u zdravstvu zemalja Bliskog Istoka. Štand Klimaopreme bio je mjesto poslovnih susreta sa mnogim postojećim te potencijalnim partnerima. Sa uredom u Ujedinjenim Arapskim Emiratima Klimaoprema je kontinuirano prisutna na tržištu te projektira, izvodi i isporučuje cleanroom i HVAC riješenja u zemljama Bliskog Istoka.

OUR LATEST REFERENCES

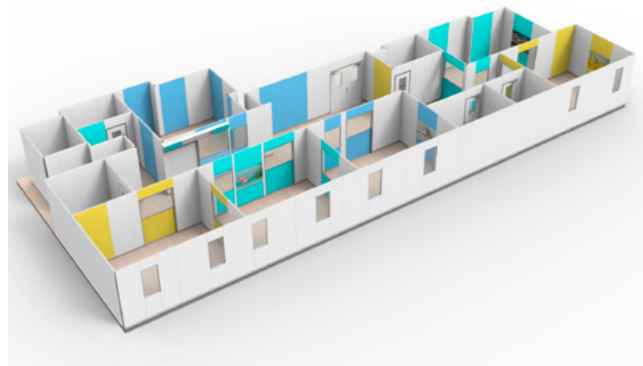
NAŠE NAJNOVIJE REFERENCE



Centar 2000 - Zagreb, Croatia
Centar 2000 - Zagreb, Croatia



KBC Pula, surgery - Pula, Hrvatska
KBC Pula, kirurgija - Pula, Hrvatska



King Fahad Specialist Hospital

Klimaoprema performed an attractive project of the intensive care unit, at King Fahad Hospital, in Dammam. These are 6 intensive care rooms, which are designed with the idea of a beautiful and attractive environment, where patients, with adequate care, will stay in a bright and modern space, which has moved away from standard hospital rooms.

Klimaoprema supplied an antibacterial panel system in a variety of colors. Part of the wall panel system is glass with a picture, in accordance with the colors of the room. Walls, doors, walk-through

ceilings and windows with built-in blinds are a solid element of equal thickness and prevent the development of bacteria. The entire cleanroom and the adequate filtration and ventilation system ensure the safety of the stay in the space, both for patients and staff.

Specijalistička bolnica King Fahad

Klimaoprema je izvela atraktivan projekt odjela za intenzivnu njegu, u bolnici King Fahad, u Dammamu. Radi se o 6 soba za intenzivnu njegu, koje su dizajnirane sa idejom lijepog i atraktivnog ambijenta, gdje će pacijenti, uz adekvatnu skrb, boraviti u svijetlom i modernom prostoru, koji se odmaknuo

od standardnih bolničkih soba. Klimaoprema je isporučila antibakterijski panelni sustav u različitim bojama. Dio zidnog panelnog sustava je staklo sa slikom, u skladu sa bojama sobe. Zidovi, vrata, prohodni stropovi te prozori sa ugrađenim žaluzinama, predstavljaju solidni element jednake debljine te sprječavaju razvoj bakterija. Cijeli sustav čistog prostora te adekvatna filtracija i ventilacijski sustav osiguravaju sigurnost boravka u prostoru, kako za pacijente, tako i za osoblje.

Helena Hrastnik, mag.oec.
Klimaoprema Middle East



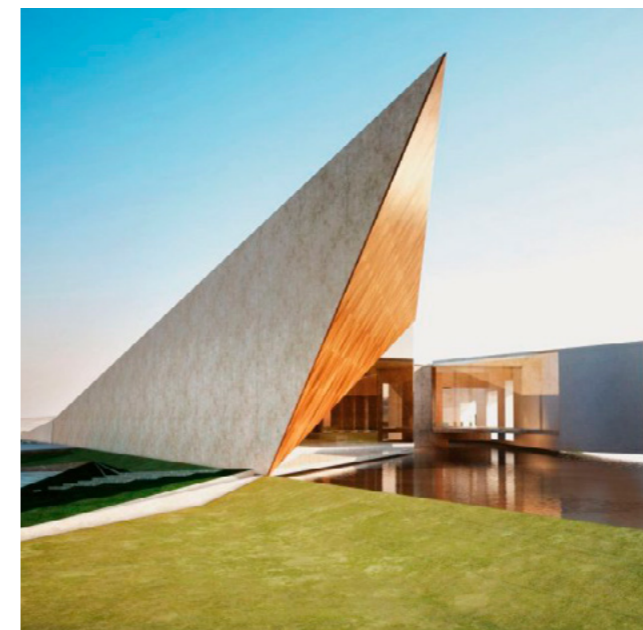
Hotel Scandic Spectrum - Copenhagen, Denmark
Hotel Scandic Spectrum - Kopenhagen, Danska



Nordseter school - Oslo, Norway
Škola Nordseter - Oslo, Norveška



Grand Park Hotel Rovinj - Rovinj, Croatia
Grand Park Hotel Rovinj - Rovinj, Hrvatska



Oman Across Ages Museum

Located in Nizwa, an ancient city in northern Oman, about 150 km from the capital Muscat, is the Cultural-Historical and Educational Museum of Oman Across Ages. The museum encompasses Oman's rich past and bright future and displays the country's achievements in an innovative and interactive way through stories of human and cultural achievements. The area of the museum is 38.600 m², construction is underway, and completion is expected in early 2021.

The complex design and arid desert climate have challenged HVAC experts to create efficient and energy-efficient ventilation system solutions. Klimaoprema

supplied HVAC equipment, mostly nozzles that allow air to be injected into the space with a long jet range and low noise. Made of aluminum, the nozzles are plasticized in special colors and, in addition to technical performance, also contribute to the overall design of the space.

Oman Across Ages Muzej

Smješten u Nizwi, drevnom gradu na sjeveru Omana, udaljenom oko 150 km od glavnog grada Muscata, nalazi se kulturno-povijesni i edukacijski muzej Oman Across Ages. Muzej obuhvaća bogatu prošlost i svijetlu budućnost Omana te na inovativan i interaktivan način prikazuje postignuća zemlje kroz priče o ljudskim i kulturnim dosti-

gnućima.

Površina muzeja je 38.600 m², gradnja je u tijeku, a završetak se očekuje početkom 2021. godine.

Kompleksan dizajn te sušna pustinjska klima izazvali su HVAC stručnjake na kreiranje efikasnih i energetski učinkovitih rješenja ventilacijskog sustava. Klimaoprema je isporučila HVAC opremu, većinom sapnice koje omogućavaju ubacivanje zraka u prostor sa velikim dometom mlaza te niskom šumnosti. Izrađene iz aluminija, sapnice su plastificirane u specijalne boje te osim tehničke izvedbe, pridonose i ukupnom dizajnu prostora.


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Klimaoprema Middle East





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