ITA Umidificatore ad acqua in pressione in BDN - Wykroty - POLONIA

ENG High pressure water humidifier in BDN - Wykroty - POLONIA

DUT Hoge druk verneveling in BDN - Wykroty - Polen

CASE STUDY

Integrated Control Solutions & Energy Savings

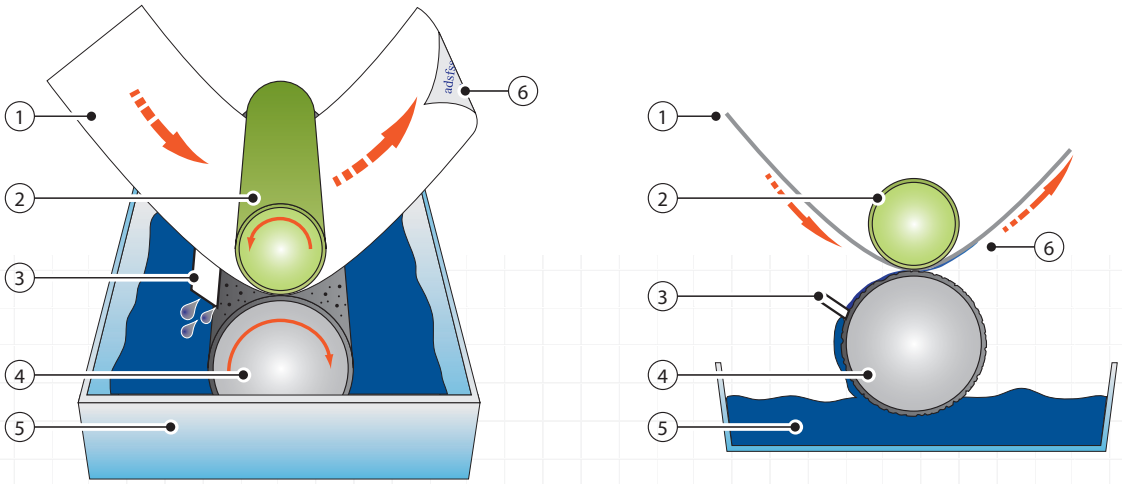
Introduzione

BDN Sp. z o.o., Rotogravure Printing House in Wykroty, vicino a Bolesławiec, e' un'azienda che stampa giornali e riviste. Il processo produttivo, per qualità e volume, è il maggiore e più avanzato in Polonia. L'azienda occupa circa 195'000 m^2 di superficie, con un'area effettiva per la produzione di 68'000m^2.
BDN fa parte del gruppo Grupa Wydawnicza Bauer (Bauer Publishing Group)ed è stata fondata da Johann Andreas Ludolph Bauer all'età di 23 anni ad Amburgo, nel 1875, per la stampa e vendita di biglietti da visita. Dopo oltre un secolo di successi,il gruppo conta ora la pubblicazione di 152 riviste in 13 paesi e impiega 6.400 lavoratori. Il suo fatturato nel 2004 era di circa 1,70 miliardi di Euro.

Processo produttivo

Stampa di giornali e riviste con la tecnica Rotogravure: l'immagine da stampare viene incisa su un supporto cilindrico, di rame, che viene utilizzato per il processo "rotativo" di stampa. Il cilindro di rame viene inciso con una macchina digitale che crea dei minuscoli forellini sulla sua superficie. I forellini conterranno l'inchiostro che verrà poi trasferito sulla carta. Nel processo rotogravure si utilizza una unità di stampa per colore, tipicamente CMYK (ciano, magenta, giallo e nero), che vengono quindi impressi uno dopo l'altro sul foglio di carta. Questo processo di stampa si applica a bobine di carta, quindi un foglio continuo, in modo da permettere una velocità di stampa tra le più elevate possibili, e una elevata flessibilità nelle dimensioni di carta stampabile.

Principio di stampa rotogravure



Legenda:
1. carta;
2. rullo pressore;
3. racla;
4. cilindro matrice;
5. vasca inchiostro;
6. lato stampato carta.

Perchè umidificare l'aria?

Il livello di umidità dell'aria è un fattore rilevante nell'industria della stampa per le proprietà della carta: essa è ottenuta a partire dalla cellulosa, vale a dire da fibre vegetali che sono intrinsecamente igroscopiche. Il contenuto d'acqua della carta si porta naturalmente in equilibrio con l'umidità relativa dell'ambiente. Ad esempio, ad una temperatura di 20 °C potrebbe esserci un contenuto in acqua pari al 6% in peso per un'umidità dell'aria del 40% che aumenta al 7% per un'umidità relativa del 60%. Questo porta ad una variazione dimensionale delle fibre vegetali e quindi il foglio di carta si ritira quando l'umidità diminuisce e si allunga quando aumenta. Come esempio pratico, un foglio di carta di larghezza pari a due fogli A4 si allunga di 1mm se l'umidità aumenta del 10%.

Inoltre, non è detto che la deformazione avvenga uniformemente: l'effetto dell'umidità dell'aria su di una risma o bobina di carta si manifesta prevalentemente nella parte perimetrale, dando luogo ad incurvamenti dei bordi del foglio e ad ondulazioni che comportano pessimi risultati quando la carta viene utilizzata nella stampa, in particolare in quella a colori, specie se stampati in fasi successive. Inoltre, le deformazioni alterano la correttezza di tutte le operazioni di taglio e di stampa.

Il controllo delle condizioni igrometriche ambientali previene anche i danni derivanti dalle cariche elettrostatiche che si producono per sfregamento di un foglio sull'altro e del foglio sulle macchine di stampa, diminuisce la polvere generata, diminuisce le forze di adesione elettrostatica tra i fogli e garantisce il corretto tenore d'acqua della carta e quindi l'assorbimento ottimale dell'inchiostro.

Per tutte queste ragioni il controllo dell'umidità dell'aria, non solo il livello di umidità, ma soprattutto un controllo accurato della sua stabilità nel tempo, rappresenta uno dei fattori principali che contribuiscono alla qualità delle operazioni di stampa, riduzione scarti ed inceppamenti delle macchine, e, cioè, aumento della produttività.

Perchè CAREL?

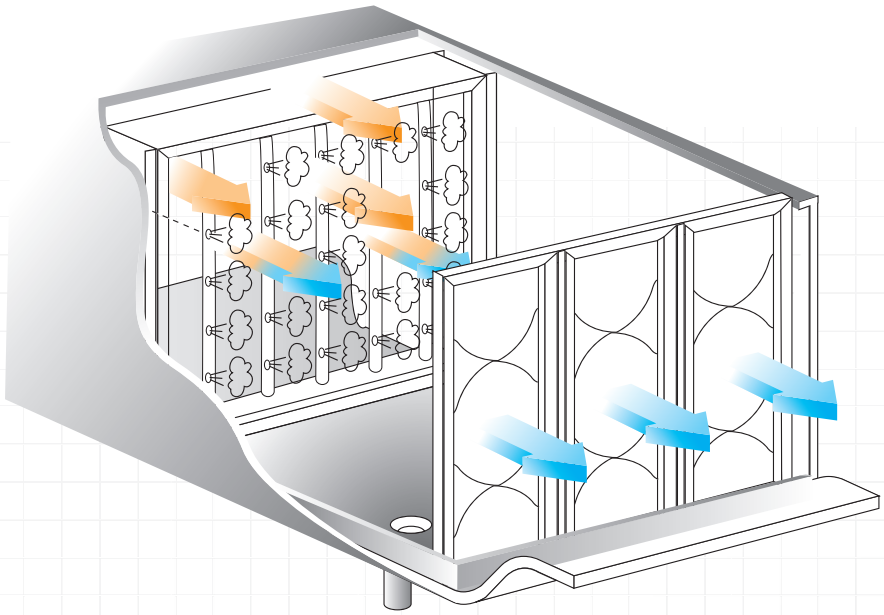
Grazie alla trentennale esperienza nella produzione di sistemi di controllo dell'umidità CAREL è il partner sicuro ed affidabile per l'industria della stampa.

Il distributore esclusivo per la Polonia, Alfaco Polska – nella persona di Mr Franciszek Klimosz, sfruttando la profonda conoscenza dell'applicazione e l'esperienza acquisita sul campo, ha fornito il supporto necessario per la fornitura della soluzione migliore per il controllo dell'umidità nel processo produttivo.

Soluzione per l'umidificazione dell'aria

L'impianto di condizionamento dell'aria è molto complesso: deve garantire le condizioni termoigronometriche e di ventilazione nei vari reparti produttivi, ognuno dei quali ha diverse esigenze, ad esempio, alcuni devono lavorare con tutta aria esterna (100% aria di rinnovo) mentre altri miscelano parte dell'aria di ritorno con l'aria di rinnovo. L'impianto costituito da 18 centrali di trattamento dell'aria (CTA).

Per la grande capacità richiesta, l'affidabilità e bassa manutenzione richiesti dall'applicazione per garantire un funzionamento continuo dell'impianto, è stato scelto di utilizzare l'humiFog. humiFog rappresenta una nuova generazione di atomizzatori adiabatici che hanno una potenza elettrica impegnata di soli 4 Watt per ogni litro/ora di acqua nebulizzata. L'humiFog è adatto a tutte le applicazioni dove è richiesta una grande capacità di umidificazione, fino a 500 kg/h. L'humiFog utilizza una pompa speciale per pressurizzare l'acqua ad alta pressione che viene poi atomizzata attraverso speciali ugelli in acciaio inox producendo una nebbia molto fine ed uniforme. Le goccioline generate evaporano spontaneamente umidificando e raffreddando l'aria.



I vantaggi dell'humiFog sono:

- **basso consumo energetico**: in media soli 4 W per (kg/h), ad esempio solo 1150W per 250 kg/h nominali;
- **grande capacità**: sono disponibili modelli standard con capacità da 60kg/h a 500kg/h;
- **nebulizzazione finissima** che richiede un minimo spazio per l'evaporazione;
- **manutenzione bassissima**: gli ugelli di atomizzazione sono praticamente privi di manutenzione, la stazione di pompaggio non si ferma per manutenzione.

A titolo di esempio, di seguito si trovano le informazioni relative a due centrali di trattamento dell'aria.

Centrali dalla D6 alla D9

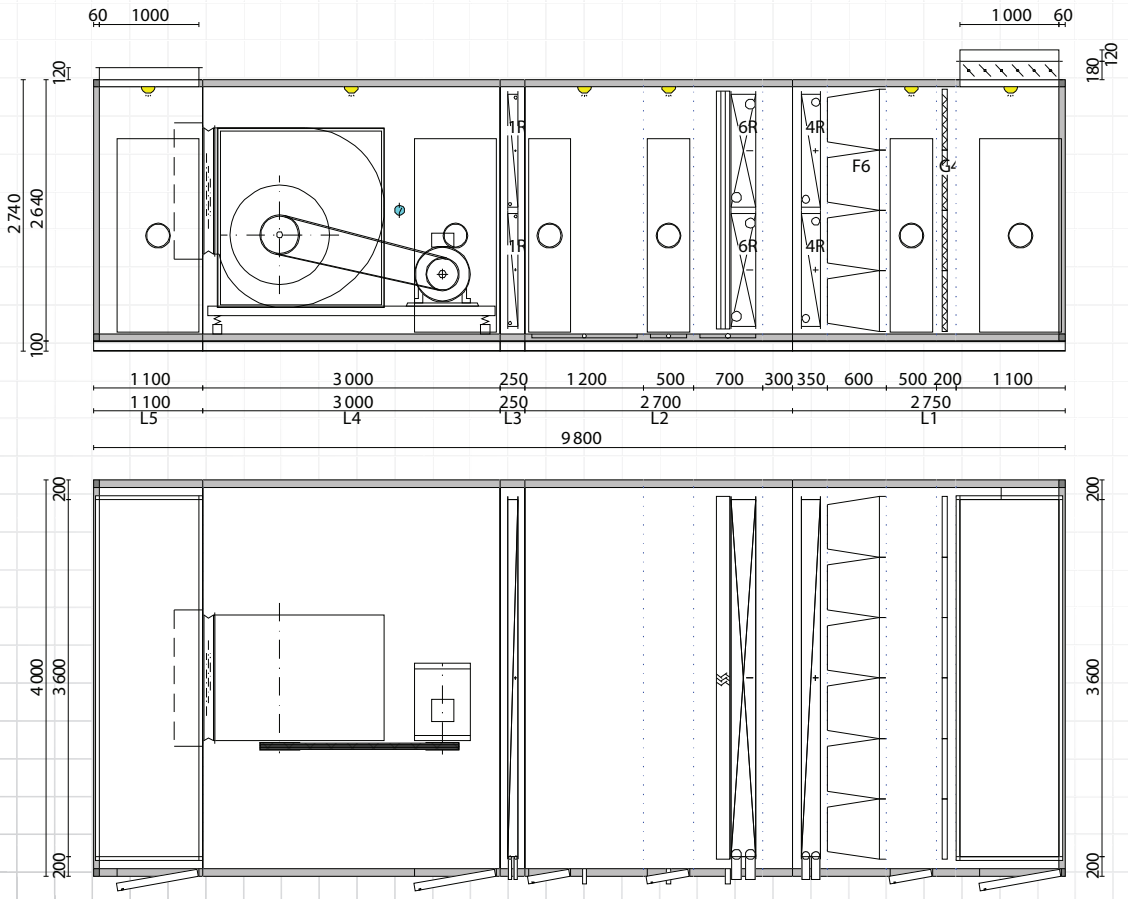
Queste quattro centrali hanno dimensioni notevoli, 4000 mm di larghezza e 2740 mm di altezza, e una portata d'aria rilevante, 102'000 m³/h. Visto che la centrale è stata progettata per lavorare con 100% aria di rinnovo, il carico di umidificazione risultate, 728.4 kg/h, è maggiore della capacità massima dell'humiFog, 500 kg/h; inoltre, la larghezza massima dei rack dell'humiFog è di circa 3000 mm, molto inferiore alla larghezza della centrale. Per questi motivi, la centrale è stata idealmente suddivisa in due sezioni, ciascuna delle quali avente metà della larghezza della CTA, che sono quindi interessate dalla metà del flusso d'aria. Ogni sezione verrà umidificata da una stazione di pompaggio humiFog e da un rack di capacità adeguata.

Scendendo nei dettagli, l'aria esterna ha condizioni invernali pari a -16.9 °C, 100% U.R., 1 g/kg (dato ASHRAE 99,6% per Wroclaw) che viene preriscaldata a 36 °C.

Quindi l'humiFog avrà le seguenti condizioni di lavoro:

Aria prima di humifog	36,0 °C	2,6% U.R.	1,0 g/kg	
Aria dopo l'humifog	21,6 °C	41,5% U.R.	6,7 g/kg	
Flusso d'aria	51.000 m³/h	(calcolata con l'humiFog calculation sheet ver 3.2 riportata di seguito)		
Capacità richiesta	364,2 kg/h			

Dimensioni delle centrali D6-D9



La soluzione tecnica e l'offerta commerciale sono state realizzate utilizzando il semplice ma potente foglio di calcolo "humiFog calculation sheet ver 3.2" che permette di dimensionare l'humiFog in maniera guidata e selezionare tutti i componenti opzionali necessari per rispondere alle richieste dell'applicazione e del cliente:

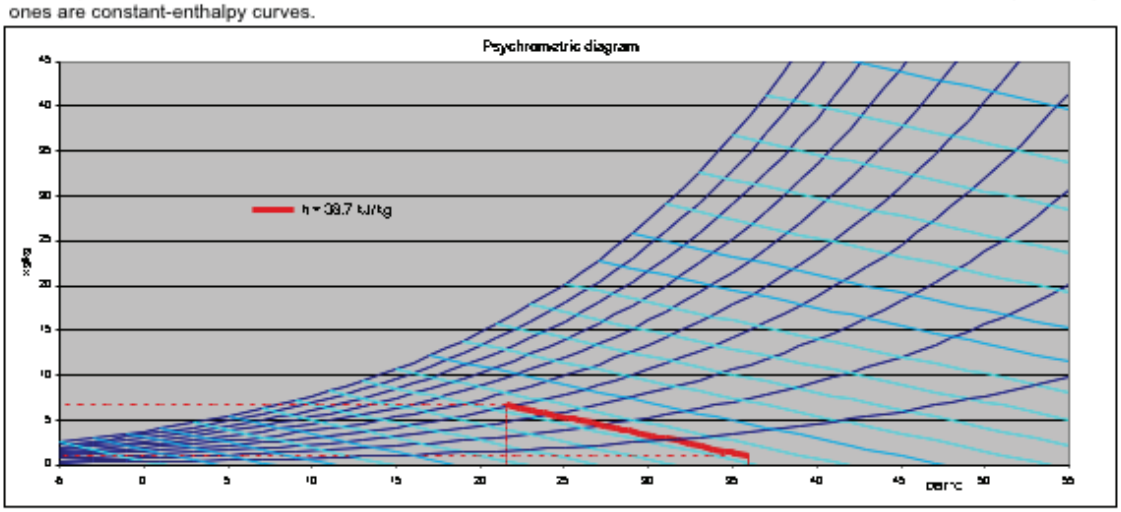
CAREL humiFog calculation sheet ver 3.2 — **AHU D06 D09**

RULES Input: cyan cells - Output: beige cells

Altitude a.s.l. 0 m

Air before humiFog			Air after humiFog		
Relative humidity	2,6%	%1 rH	Relative humidity	41,5%	%2 rH
Temperature	36,0	t1 °C	Temperature	21,6	t2 °C
Specific humidity	1,0	x1 g/kg	Specific humidity	6,7	x2 g/kg
			Difference x2-x1	5,7	g/kg

The diagram below shows the adiabatic transformation in red. Blue lines represent curves at a fixed relative humidity, while cyan ones are constant-enthalpy curves.

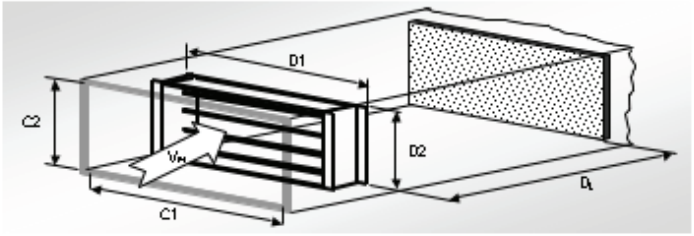


(1) Saturation efficiency is estimated to be η 64%

(1) Is the ratio between the required difference of specific humidity and the difference to achieve saturation Area humidity 100% rH.

Duct

Internal width C1	1925	mm
Internal height C2	2500	mm
Distance nozzle - drop separator DL	1750	mm
Air flow V	51.000	m^3/h
Air flow GA	58.219	kg/h
Air speed	2,94	m/sec



Water flows

Water to be absorbed Gv	kg/h	345,9
(2) Absorbtion efficiency	ε	95%

(2) Is the estimated ratio between the water absorbed by the air and the sprayed water.

Total water flow Gw 364,2 kg/h

Ognuna delle due sezioni in cui è stata suddivisa la centrale verrà quindi trattata con quanto segue:

Rif	Codice	Descrizione	
AHU D06 D09	UA500HD111	stazione di pompaggio + controllore+ Inverter - 230 V - 50 Hz	
		Capacità nominale (kg/h)	500
		Materiale della pompa	AISI316
		Smorzatore	sì
	Rack	Rack di atomizzazione con elettrovalvole e ugelli.	
		Numero di elettrovalvole	7
		Numero di ugelli	92
		Tipo ugelli	2
		Larghezza (mm)	1762
		Altezza (mm)	2332
		Distanza ugelli-separatore di gocce (mm)	1750
	Separatore di gocce		
	UAKT100000 Kit L= 2,0 m. Tubo flessibile con adattatore		

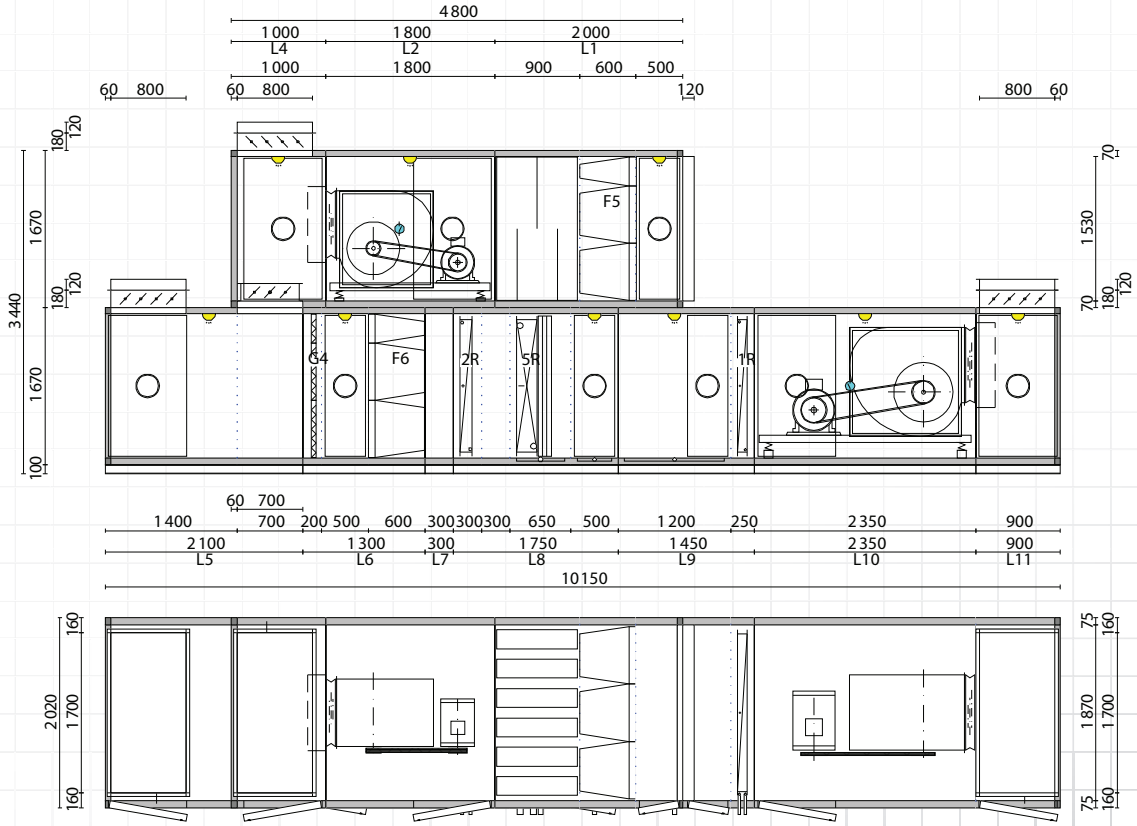
Centrali dalla D11 alla D13

Queste quattro centrali hanno dimensioni inferiori a quelle appena analizzate, con una portata d'aria di 26'500 m³/h. L'aria di rinnovo viene miscelata con una parte di aria di ritorno ottenendo condizioni termoigronometriche a monte dell'umidificatore pari a 22 °C - 27,5% U.R., quindi relativamente fredda e umida. A valle dell'umidificatore l'aria può essere post riscaldata per raggiungere il setpoint di temperatura desiderato. La proposta si è svolta come segue:

Dati di progetto:

Aria prima di humifog	22,0 °C	27,5% U.R.	4,5 g/kg	
Aria dopo l'humifog	14,5 °C	72,5% U.R.	7,5 g/kg	
Flusso d'aria	26.500 m³/h	(calcolata con l'humiFog calculation sheet ver 3.2 riportata di seguito)		
Capacità richiesta	116,6 kg/h			

Dimensioni delle centrali D11-D13



Utilizzando il foglio di calcolo "humiFog calculation sheet ver 3.2" si ottiene:

CAREL humiFog calculation sheet ver 3.2

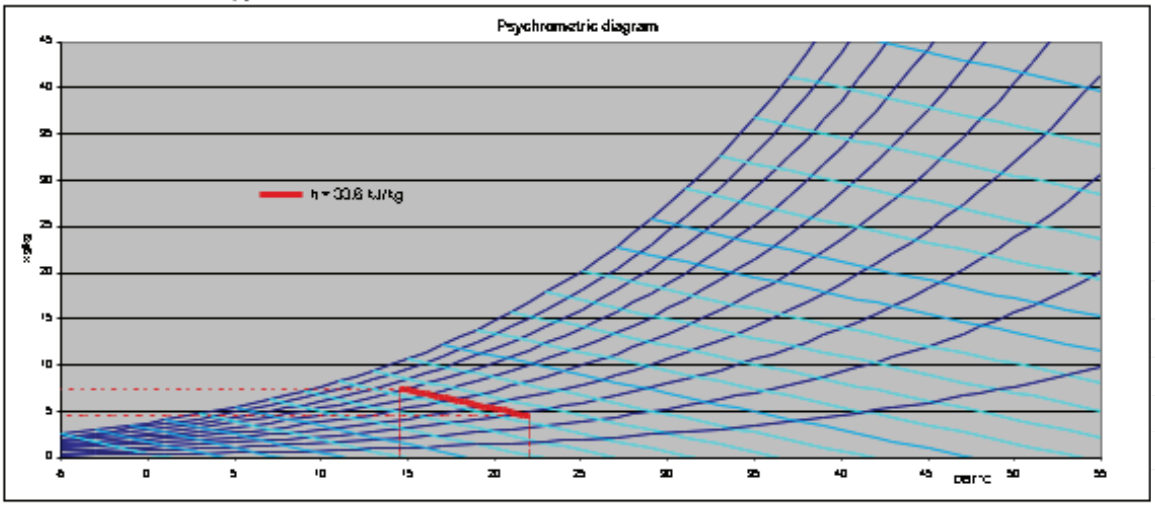
AHU D11 D13

RULES Input: cyan cells - Output: beige cells

Altitude a.s.l. 0 m

Air before humiFog			Air after humiFog		
Relative humidity	27,5%	%1 rH	Relative humidity	72,5%	%2 rH
Temperature	22,0	t1 °C	Temperature	14,5	t2 °C
Specific humidity	4,5	x1 g/kg	Specific humidity	7,5	x2 g/kg
			Difference x2-x1	3,0	g/kg

The diagram below shows the adiabatic transformation in red. Blue lines represent curves at a fixed relative h
ones are constant-enthalpy curves.

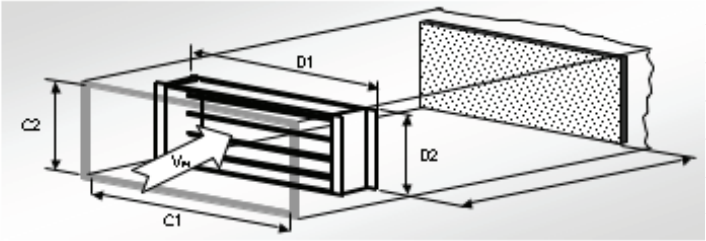


(1) Saturation efficiency is estimated to be η 73%

(1) Is the ratio between the required difference of specific humidity and the difference to achieve saturation (relative humidity 100% rH).

Duct

Internal width C1	1870	mm
Internal height C2	1530	mm
Distance nozzle - drop separator DL	1700	mm
Air flow V	26.500	m^3/h
Air flow GA	31.506	kg/h
Air speed	2,57	m/sec



Water flows

Water to be absorbed Gv	kg/h	96,2
(2) Absorbtion efficiency	ε	83%

(2) Is the estimated ratio between the water absorbed by the air and the sprayed water.

Total water flow Gw 116,6 kg/h

Quindi l'aria delle centrali D11-D13 verrà umidificata con un sistema humiFog come segue:

Rif.	Codice	Descrizione	
AHU D11 D13	UA120HD111	stazione di pompaggio + controllore+ Inverter - 230 V - 50 Hz	
		Capacità nominale (kg/h)	120
		Materiale della pompa	AISI316
		Smorzatore	sì
	Rack	Atomisation rack with manifolds, solenoid valves and nozzle.	
		Numero di elettrovalvole	3
		Numero di ugelli	31
		Tipo ugelli	2
		Larghezza (mm)	1762
		Altezza (mm)	1420
		Distanza ugelli-separatore di gocce (mm)	1700
	Separatore di gocce		
	UAKT100000 Kit L= 2,0 m. Tubo flessibile con adattatore		

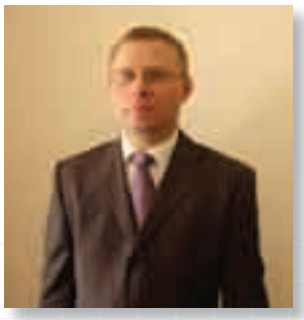
Conclusioni

Le 18 centrali di trattamento dell'aria vengono umidificate da 24 humiFog controllati dal BMS che gestisce il sistema di condizionamento dell'aria dell'intero impianto industriale. Il carico totale di umidificazione è di 6120 kg/h.

I set point di di umidità vengono mantenuti secondo i requisiti di progetto.

La commessa è stata sviluppata grazie all'attiva collaborazione tra Carel HQ in Italia ed Alfaco Polska – distributore esclusivo per Carel in Polonia – nella persona di Mr Franciszek Klimosz – Direttore commerciale.

Questo ha contribuito molto alla soddisfazione del cliente che, oltre a prodotti eccellenti per qualità e affidabilità, ha trovato un valido partner per la sua applicazione di umidificazione industriale per il processo della stampa.



Franciszek Klimosz - Director Alfaco Polska

NOTE

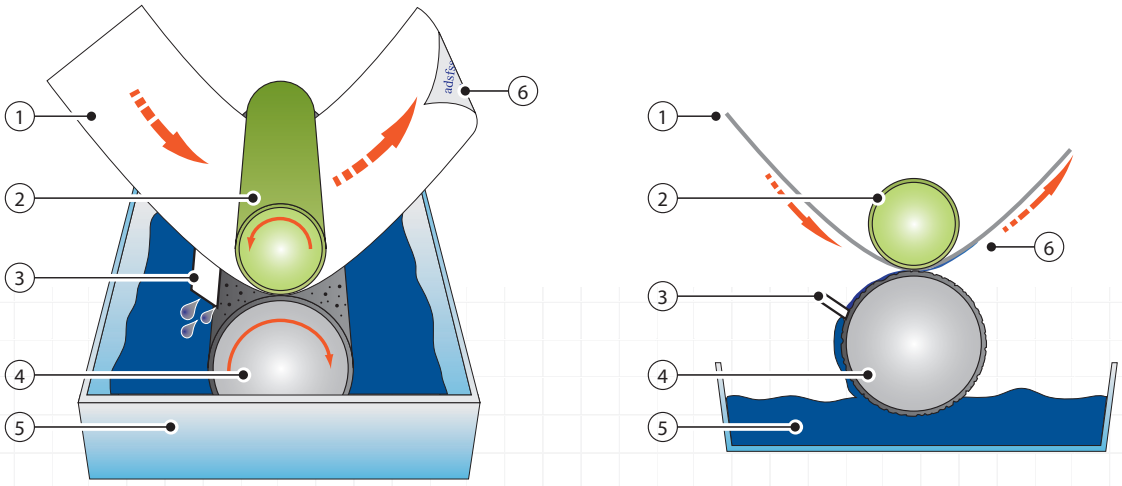
Customer

BDN Sp. z o.o., Rotogravure Printing House located in Wykroty, near Bolesławiec, is a company that prints newspapers and magazines. The production process, in terms of quality and volumes, is the largest and most advanced in Poland. The facilities cover a surface area of around 195,000 m^2, with an effective production area of 68,000m^2.
BDN is part of the Grupa Wydawnicza Bauer group (Bauer Publishing Group), founded by 23-year-old Johann Andreas Ludolph Bauer in Hamburg, in 1875, as a business printing and selling business cards. After more than a century of successes, the group now publishes 152 magazines in 13 countries and employs 6,400 staff. Its sales in 2004 were around 1.7 billion euro.

Production process

printing newspapers and magazines with the rotogravure technique: the image to be printed is engraved onto a copper cylinder, used for the "rotary" printing process. The copper cylinder is engraved using a digital device that creates minute dots on the surface. The dots contain the ink that is then transferred to the paper. The rotogravure process has one printing unit for each colour, typically CMYK (cyan, magenta, yellow and black), which are then pressed one after the other onto the sheet of paper. This printing process uses reels of paper, i.e. a continuous sheet, so as to ensure the highest possible printing speed, as well as considerable flexibility in terms of paper size.

Rotogravure printing principle



Key:
1. paper;
2. impression roll;
3. doctor blade;
4. gravure cylinder;
5. ink fountain;
6. printed side of paper.

Why humidify the air?

The level of air humidity is a significant factor in the printing industry due to the properties of paper: this is made from cellulose, that is, plant fibres that are intrinsically hygroscopic. The moisture content of the paper naturally tends towards equilibrium with the ambient relative humidity. For example, at a temperature of 20 °C, the moisture content may be around 6% by weight at a relative humidity of 40%, which increases to 7% when the relative humidity is 60%. This increase causes variations in the dimensions of the plant fibres and consequently the sheet of paper, which shrinks when the humidity decreases and lengthens when it increases. As a practical example, a sheet of paper measuring two A4 sheets in width becomes 1 mm longer when the humidity increases by 10%.

In addition, such deformations are not necessarily uniform: the effect of moisture in the air on a ream or reel of paper is more prevalent around the perimeter, causing the edges of the sheet to curl up as well as undulations in the sheet, meaning very poor results when the paper is printed on, especially for colour printing in a sequence of phases. Moreover, the deformations affect the quality of all the cutting and printing operations.

Controlling the ambient humidity also prevents damage caused by the electrostatic charges that are generated by the sheets rubbing together and the sheets rubbing on the printing presses, decreases the amount of dust produced, decreases the forces of electrostatic adhesion between the sheets and guarantees the correct moisture content in the paper and consequently optimum ink absorption.

For all these reasons, control of air humidity, not just the level but above all its stability over time, is one of the main factors that ensure quality printing, reducing rejects and the jamming of machinery, in other words, increasing productivity.

Because CAREL?

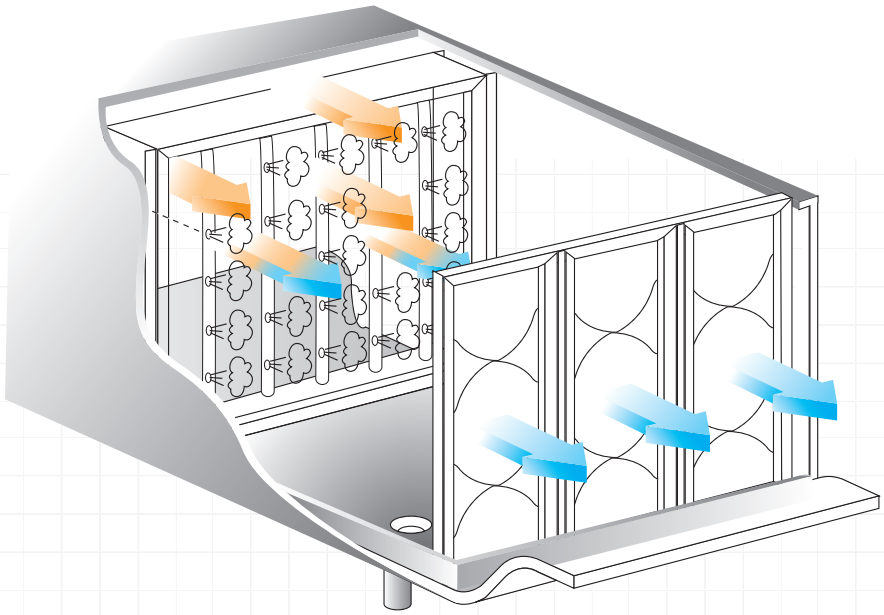
With over thirty years of experience in the production of humidity control systems, CAREL is the most solid and reliable partner for the printing industry.

The exclusive distributor for the Poland, Alfaco Polska – through Mr Franciszek Klimosz, with in-depth knowledge of the application and experience acquired in the field, provided the support needed to supply the best solution for humidity control in the production process.

Air humidification solution

The air-conditioning system is very complex: it has to guarantee the temperature-humidity and ventilation conditions in the various production departments, each with different needs; for example, some operate with outside air only (100% fresh air), while others mix some of the return air with the fresh air. The installation consists of 18 air handling units (AHU).

To meet the requirements of high capacity, reliability and low maintenance and ensure the continuous operation of the installation, a humiFog solution was chosen. humiFog represents a new generation of adiabatic atomisers with a power input of just 4 watts for each litre/hour of atomised water. humiFog is suitable for all applications that require a high humidification capacity, up to 500 kg/h. humiFog uses a special pump to deliver the water at high pressure to special stainless steel nozzles, which atomise the water, producing a very fine and uniform mist. The droplets generated evaporate spontaneously, humidifying and cooling the air.



The advantages of humiFog are:

- **Low energy consumption**: on average just 4 W per (kg/h), for example just 1150W for a rated capacity of 250 kg/h
- h**igh capacity**: standard models are available with capacities from 60kg/h to 500kg/h
- **very fine spray** that requires minimum space for evaporation
- **very low maintenance**: the atomisation nozzles are practically maintenance-free, the pumping system does not need to be stopped for maintenance.

As an example, below is information relating to two of the air handling units.

Units D6 to D9

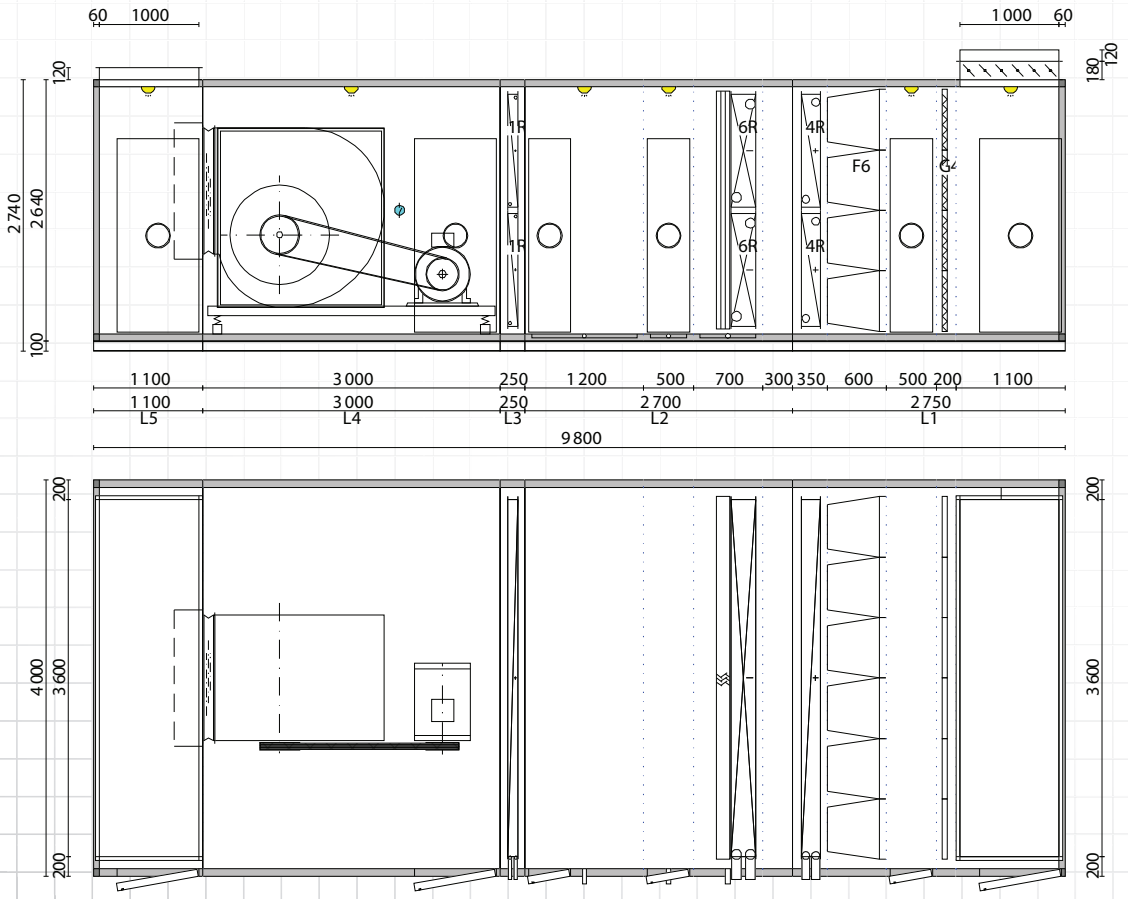
These four units are quite large, 4000 mm wide and 2740 mm high, with a significant air flow-rate, 102,000 m³/h. As the units have been designed to work with 100% fresh air, the resulting humidification load, 728.4 kg/h, is greater than the maximum capacity of the humiFog, 500 kg/h; in addition, the maximum width of the humiFog rack is around 3000 mm, much less than the width of the unit. For these reasons, the unit has been virtually divided into two sections, each of which covering half of the width of the AHU, and consequently handling half of the air flow. Each section will be humidified by a humiFog pumping system with a suitably-sized rack.

In detail, the outside air conditions in winter are -16.9 °C, 100%rH, 1 g/kg (ASHRAE data 99.6% for Wroclaw), and this is pre-heated to 36 °C.

humiFog will thus have the following operating conditions:

Air before humiFog	36,0 °C	2,6% rH	1,0 g/kg	
Air after humiFog	21,6 °C	41,5% rH	6,7 g/kg	
Air flow V	51.000 m³/h	(calculated using humiFog calculation sheet ver 3.2 shown below)		
Water flow-rate required	364,2 kg/h			

Dimensions of units D6-D9



The technical solution and the quotation were developed using the simple yet powerful "humiFog calculation sheet ver 3.2", which is used to size the humiFog through a guided process and select all the optional components needed to meet the requirements of the application and the customer:

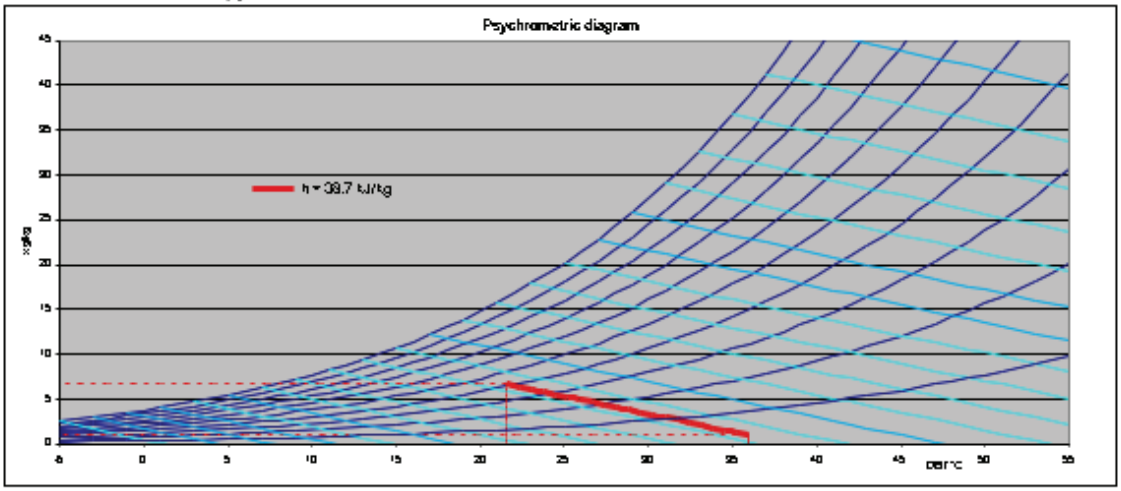
CAREL humiFog calculation sheet ver 3.2 — **AHU D06 D09**

RULES Input: cyan cells - Output: beige cells

Altitude a.s.l.	0	m

Air before humiFog			Air after humiFog		
Relative humidity	2,6%	%1 rH	Relative humidity	41,5%	%2 rH
Temperature	36,0	t1 °C	Temperature	21,6	t2 °C
Specific humidity	1,0	x1 g/kg	Specific humidity	6,7	x2 g/kg
			Difference x2-x1	5,7	g/kg

The diagram below shows the adiabatic transformation in red. Blue lines represent curves at a fixed relative humidity, while cyan ones are constant-enthalpy curves.

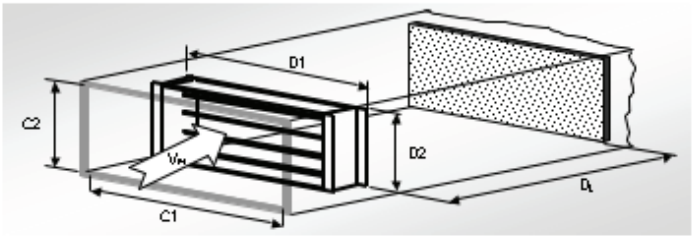


(1) Saturation efficiency is estimated to be — η — 64%

(1) Ratio between the required difference of specific humidity and the difference to achieve saturation Area humidity 100% rH.

Duct

Internal width C1	1925	mm
Internal height C2	2500	mm
Distance nozzle - drop separator DL	1750	mm
Air flow V	51.000	m^3/h
Air flow GA	58.219	kg/h
Air speed	2,94	m/sec



Water flows

Water to be absorbed Gv	kg/h	345,9
(2) Absorbtion efficiency	ε	95%

(2) Ratio between water absorbed by the air and the sprayed water.

Total water flow Gw — 364,2 kg/h

Each of the two sections that the unit has been divided into will thus be equipped as follows:

Rif	Code	Description	
AHU D06 D09	UA500HD111	Pumping station + controller + Variable Frequency Driver - 230 V - 50 Hz	
		Water flow (kg/h)	500
		Pump material	AISI316
		Dampener	sì
	Rack	Atomisation rack with manifolds, solenoid valves and nozzle.	
		no. of solenoid valves	7
		no. of nozzles	92
		Nozzle MTP	2
		Width (mm)	1762
		Height (mm)	2332
		Distance nozzle - drop separator DL (mm)	1750
	Drop separator		
	UAKT100000 Kit L= 2,0 m. Hose with adaptor		

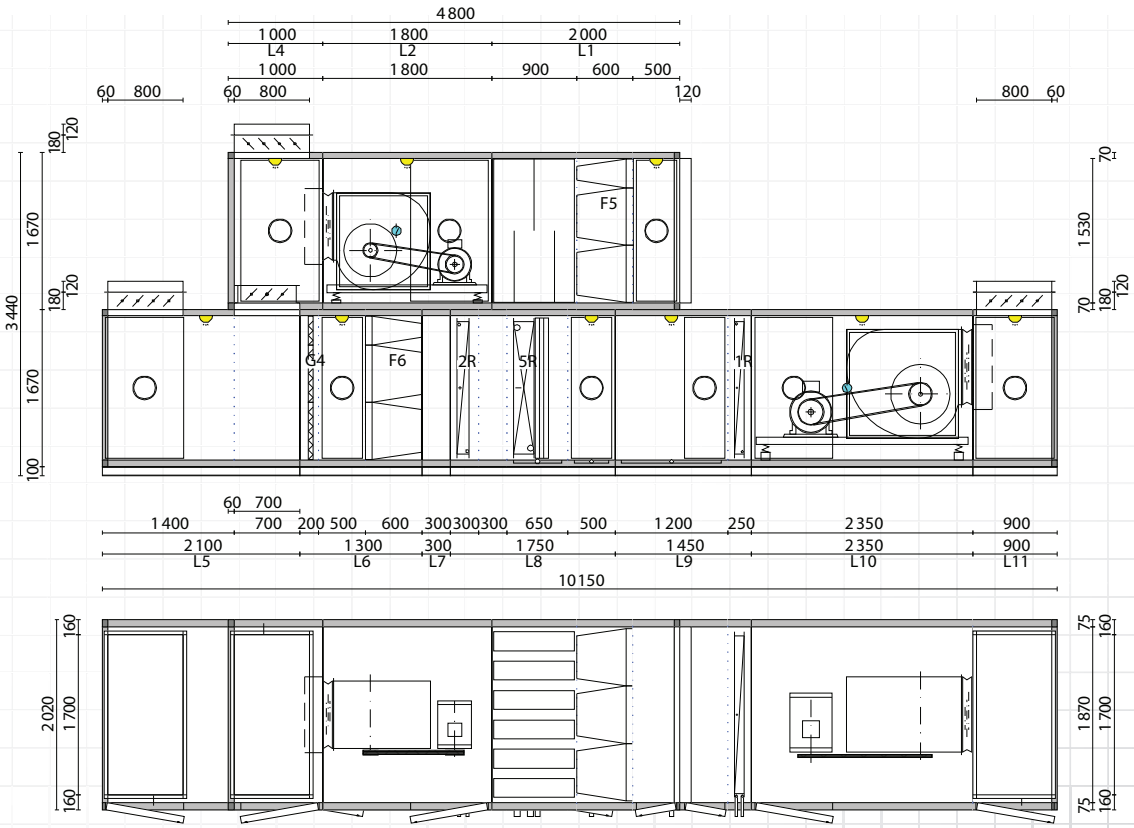
Units D11 to D13

These four units are smaller than the ones analysed above, with an air flow-rate of 26,500 m³/h. The fresh air is mixed with some of the return air, giving temperature-humidity conditions upstream of the humidifier of 22°C - 27.5% rH, i.e. relatively cool and humid. Downstream of the humidifier, the air can be post-heated to reach the desired temperature set point. The proposal is as follows:

Design data:

Air before humiFog	22,0 °C	27,5% rH	4,5 g/kg	
Air after humiFog	14,5 °C	72,5% rH	7,5 g/kg	
Air flow V	26.500 m³/h	(calculated using humiFog calculation sheet ver 3.2 shown below)		
Water flowrate required	116,6 kg/h			

Dimensions of units D11-D13



Using the "humiFog calculation sheet ver 3.2" gives:

CAREL humiFog calculation sheet ver 3.2

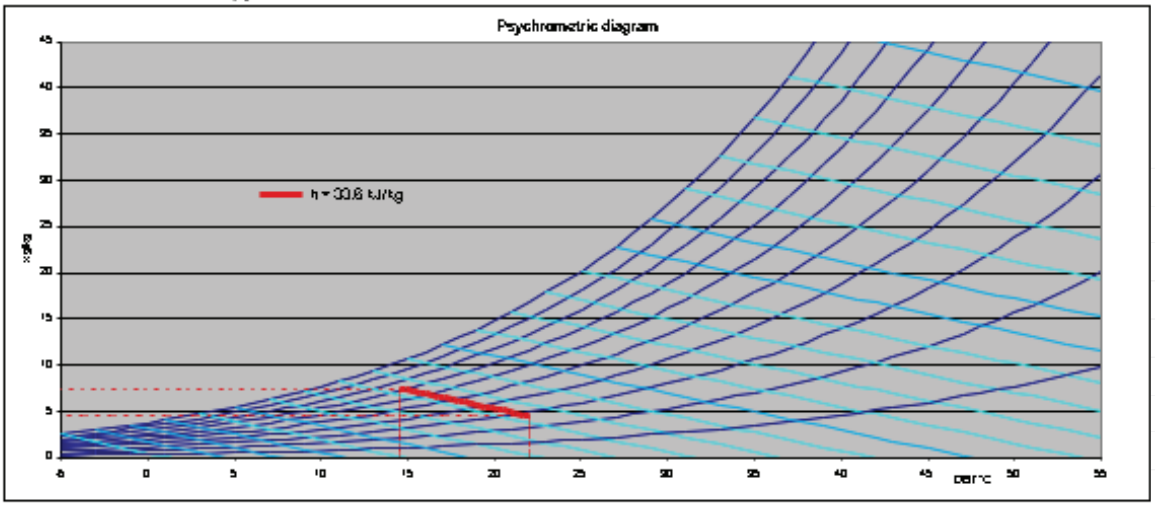
AHU D11 D13

RULES Input: cyan cells - Output: beige cells

Altitude a.s.l. 0 m

Air before humiFog			Air after humiFog		
Relative humidity	27,5%	%1 rH	Relative humidity	72,5%	%2 rH
Temperature	22,0	t1 °C	Temperature	14,5	t2 °C
Specific humidity	4,5	x1 g/kg	Specific humidity	7,5	x2 g/kg
			Difference x2-x1	3,0	g/kg

The diagram below shows the adiabatic transformation in red. Blue lines represent curves at a fixed relative h
ones are constant-enthalpy curves.

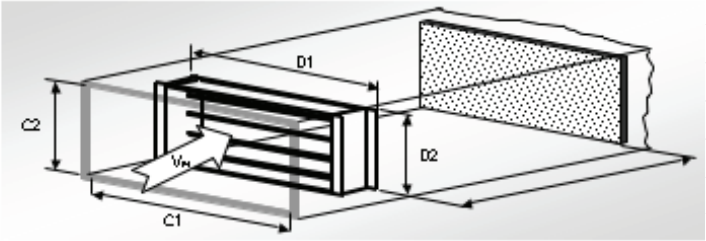


(1) Saturation efficiency is estimated to be η 73%

(1) Is the ratio between the required difference of specific humidity and the difference to achieve saturation (relative humidity 100% rH).

Duct

Internal width C1	1870	mm
Internal height C2	1530	mm
Distance nozzle - drop separator DL	1700	mm
Air flow V	26.500	m^3/h
Air flow GA	31.506	kg/h
Air speed	2,57	m/sec



Water flows

Water to be absorbed Gv	kg/h	96,2
(2) Absorbtion efficiency	ε	83%

(2) Is the estimated ratio between the water absorbed by the air and the sprayed water.

Total water flow Gw 116,6 kg/h

Consequently, the air in units D11-D13 will be humidified with a humiFog system as follows:

Rif	Code	Description	
AHU D11 D13	UA120HD111	Pumping station + controller + Variable Frequency Driver - 230 Volt - 50 Hz	
		Water flow kg/h	120
		Pump material	AISI316
		Dampener	sì
	Rack	Atomisation rack with manifolds, solenoid valves and nozzle.	
		no. of solenoid valves	3
		no. of nozzles	31
		Nozzle MTP	2
		Width mm	1762
		Height mm	1420
		Distance nozzle - drop separator DL mm	1700
	Drop separator		
	UAKT100000 Kit L= 2,0 m. Hose with adaptor		

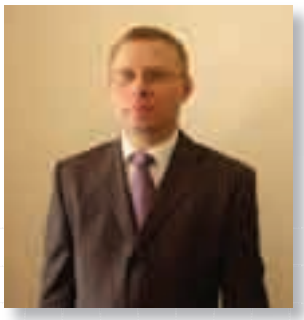
Conclusion

The 18 air handling units are humidified by 24 humiFog systems, controlled by the BMS that manages the entire air-conditioning system in the facilities. The total humidification load is 6120 kg/h.

The humidity set points are met, in accordance with the design requirements.

The order was acquired thanks to the active collaboration between Carel HQ in Italy and Alfaco Polska – exclusive Carel distributor in Poland – through Mr Franciszek Klimosz – Sales Manager.

This contributed considerably to satisfying the customer that, as well as excellent products in terms of quality and reliability, also found a dependable partner for industrial humidification applications in the printing process.



Franciszek Klimosz - Director Alfaco Polska

NOTE

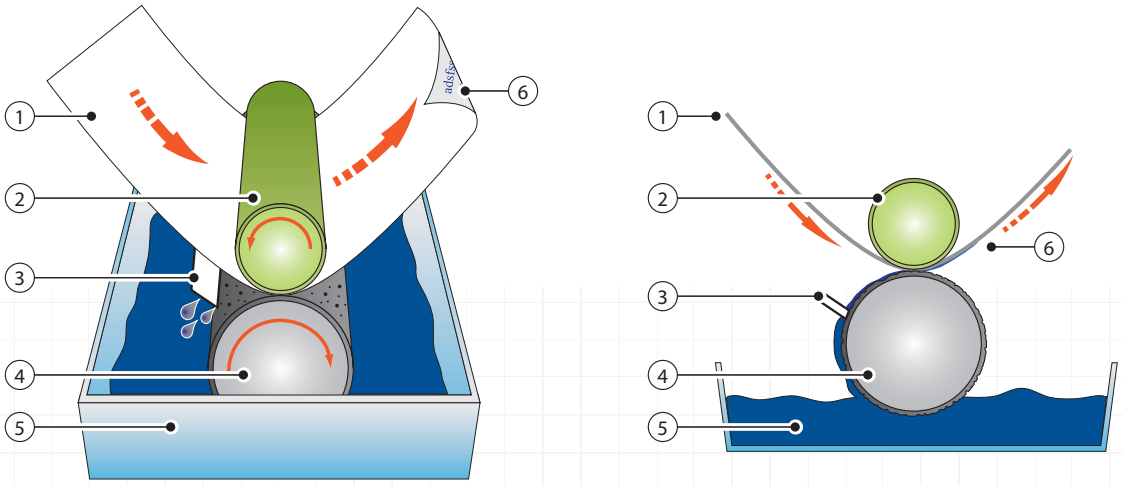
KLANT

BDN Sp. Z o.o, Rotogravure drukkerij in Wykroty, dichtbij Boleslawiec, is een bedrijf dat kranten en magazines drukt. Het productieproces is uitgedrukt in kwaliteit en volume de grootste en meest vooruitstrevende in Polen. Het bestrijkt en oppervlakte van ongeveer 195.000 m2 met een effectieve productie oppervlakte van 68.000m2. BDN is onderdeel van de Grupa Wydawnicza Bauer Group (Bauer Publishing Group), in 1875 opgericht door de 23 jarige Johann Andreas Ludolph Bauer in Hamburg als een drukkerij voor visite kaartjes. Na meer dan een eeuw van succes, publiceert de groep nu 125 magazines in 13 landen en werken er meer dan 6.400 mensen met een jaaromzet van meer dan € 1,4 x 10^9.

Productie proces

Printen van kranten en magazines met de diepdruk techniek: de afbeelding die moet worden geprint is in een koperen cilinder gegraveerd welke wordt gebruikt voor het "rotary"print proces. De koperen cilinder is met behulp van een digitale techniek bewerkt die minuscule puntjes in de oppervlakte aanbrengt. Deze puntjes bevatten de inkt die dan weer op het papier wordt aangebracht. Dit proces heeft voor iedere kleur een aparte unit die dan één voor één op het papier worden aangebracht. Dit drukproces gebruikt rollen papier of continue aanvoer van vellen om verzekerd te zijn van hoge snelheid en om een hoge mate van flexibiliteit te houden met betrekking tot de afmetingen van het papier.

Principe van rotogravure



Onderdelen:
1. papier
2. drukrol
3. rakel
4. gegraveerde cilinder
5. inktbad
6. bedrukte kant.

Waarom bevochtigen we de lucht?

De hoeveelheid vocht in de lucht is, vanwege de eigenschappen van het papier, een belangrijke factor in de grafische industrie.
Papier is gemaakt van cellulose, een plantaardige vezel, wat hygroscopisch is. Het vochtgehalte van het papier is in evenwicht met de relatieve vochtigheid van de omringende lucht. Bijvoorbeeld, bij een temperatuur van 20 °C en een relatieve vochtigheid van 40% bestaat de lucht, voor ongeveer 6% van zijn gewicht, uit vocht welke kan oplopen tot 7% bij een relatieve vochtigheid van 60%. Deze toename veroorzaakt veranderingen in de afmetingen van de plantvezels en daarmee dus ook het papier. Deze krimpt bij afname van de relatieve vochtigheid en zet uit bij toename hiervan. Als praktisch voorbeeld, Een vel papier van 2x A4 wordt 1 mm langer als de vochtigheid met 10% toeneemt.

Dit soort vervormingen zijn niet altijd gelijkmatig. Het effect van vocht in de lucht op een vel of rol papier is meer zichtbaar aan de omtrek van het papier die zowel gaat opkrullen als golven wat resulteert in zeer slechte kwaliteit als het papier wordt bedrukt speciaal bij het drukken met kleuren in serie of in fases. Bovendien, de vervormingen heeft effect op de kwaliteit bij zowel het snijden als het bedrukken.

Het regelen van het vocht in de omgeving voorkomt tevens schade die veroorzaakt wordt door statische ontladingen die ontstaan doordat papier langs elkaar heen en over de drukrollen glijdt. Tevens verminderd het de hoeveelheid stof in de lucht, het verminderd de adhesie tussen de vellen papier. De juiste hoeveelheid vocht in de lucht garandeert tevens de optimale absorptie van het inkt.

Om al deze redenen is het regelen van de luchtvochtigheid, niet allen de hoeveelheid maar ook het niveau gedurende het hele proces, één van de hoofd factoren voor het waarborgen van een goede print kwaliteit. Het reduceert productie uitval en het vastlopen van machines. In andere woorden: Het verhoogt de productiviteit.

Waarom CAREL?

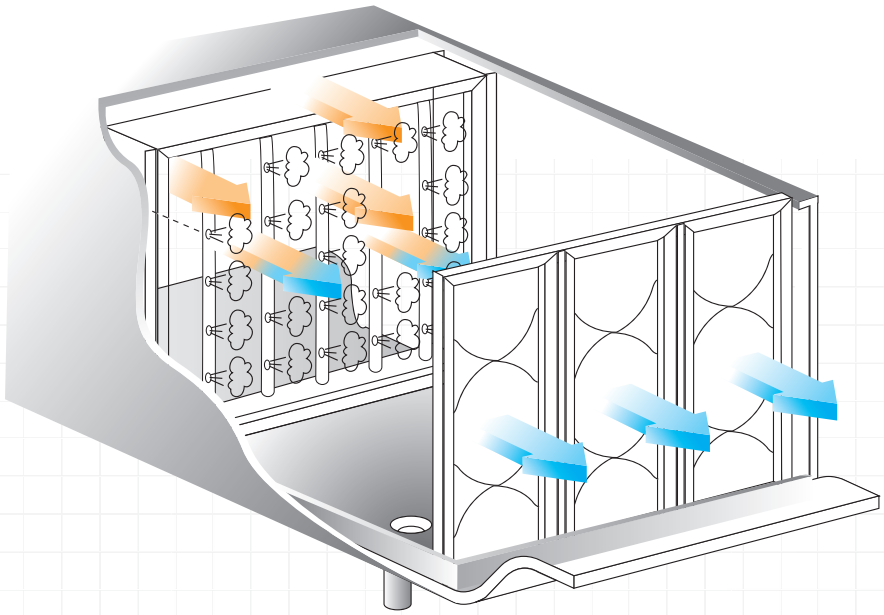
Met meer dan 30 jaar ervaring in het produceren van regelsystemen voor het beheersen van de luchtvochtigheid, is CAREL de meest stabiele en betrouwbare partner voor de grafische industrie

De exclusieve distributeur van Polen, Alfaco Polska – met de heer Franciszek Klimosz met een grote kennis van de toepassingen en ervaringen die in het veld benodigd zijn, leverde de ondersteuning die nodig is om de beste oplossing te kunnen leveren voor het regelen van de luchtvochtigheid voor het productieproces.

Oplossingen voor de luchtvochtigheid

Het luchtconditioneringsysteem is erg complex. Het moet de temperatuur, de relatieve vochtigheid en ventilatiecondities in de diverse productiegebieden, ieder met zijn eigen behoeftes, kunnen garanderen. Bijvoorbeeld: sommige gebieden werken met 100% buitenlucht terwijl andere de retour- met de buitenlucht mengen. De complete installatie bestaat uit 18 luchtbehandelingskasten.

Om te kunnen voldoen aan de eisen van hoge capaciteit, betrouwbaarheid, lage onderhoudskosten en het kunnen verzekeren van de werking van de installatie, is er gekozen voor de humiFog installatie. humiFog vertegenwoordigd een nieuwe generatie van adiabatische vernevelaars met een opgenomen vermogen van slechts 5 Watt voor iedere liter water die per uur verneveld wordt. De humiFog is geschikt voor iedere toepassing die een grote bevochtigingcapaciteit vereisen, tot 500 kg/h. Het gebruikt een speciale pomp die het water onder hoge druk door speciale RVS verstuivers perst. Hierdoor ontstaat een zeer fijne uniforme nevel. Deze nevel verdampt spontaan waardoor de lucht bevochtigd en afgekoeld wordt.



De voordelen van de humiFog zijn:

- **Laag energieverbruik**: een gemiddelde van nog geen 5 Watt per kg/h. Bijvoorbeeld, een humiFog voor 250 kg/h verbruikt zo'n 1150 Watt
- **Hoge capaciteit:** Standaard modellen zijn verkrijgbaar met capaciteiten van 60 kg/h tot en met 500 kg/h
- **Erg fijne nevel:** Voor een minimaal verdampings traject
- **Lage onderhoudskosten**: De verstuivers zijn praktisch onderhoudsvrij, Het pompsysteem kan gewoon doordraaien gedurende het onderhoud.

Hierna vindt u wat gegevens met betrekking tot twee luchtbehandelingskasten.

Luchtbehandelingskast D6 tot en met D9

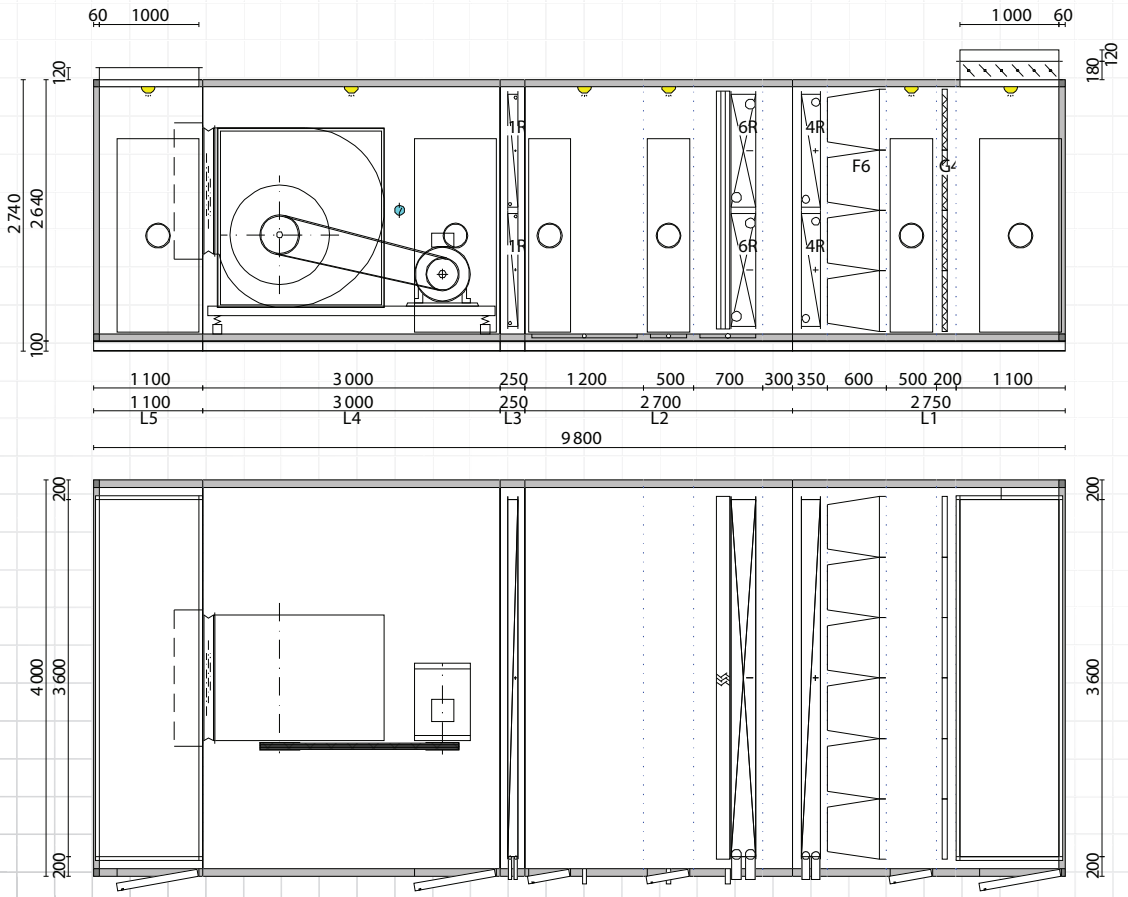
Deze vier kasten zijn redelijk groot, 4000 mm breed, 2740 mm hoog met een luchtverplaatsing van 102.000 m3/h. De kasten zijn ontworpen om met 100% buitenlucht te werken. Hieruit volgt dat er een 728,4 kg/h aan vocht nodig is welke groter is dan de grootse humiFog van 500 kg/h. De maximale breedte van de humiFog is ook 3000 mm, veel kleiner dan de breedte van de kast. Daarom werd de kast visueel in twee secties verdeeld die ieder de helft van de kast waren en dus ook maar de helft van de lucht verplaatsten. Iedere sectie werd bevochtigd door een humiFog pompsysteem met een opmaat gemaakt rek en druppelvanger.

Verdere details: De buitentemperatuur in de winter is -16,9 °C, 100% rv, 1 g/kg (ASHRAE data 99,6% voor Wroclaw)
En deze wordt voorverwarmd tot 36 °C.

De humiFog heeft dus de volgende werkingscondities:

Lucht voor de bevochtiger	36,0 °C	2,6% rv	1 g/kg	
Lucht na de bevochtiger	21,6 °C	41,5% rv	6,7 g/kg	
Lucht verplaatsing	51.000 m³/h	Berekend met het humiFog calculatieprogramma versie 3.2 zie volgende pagina		
Vereiste capaciteit	364,2 kg/h			

Afmetingen van de units D6 – D9



De technische oplossing en de aanbieding zijn ontworpen door het gemakkelijke maar krachtige "humiFog berekeningspprogramma versie 3,2", welke is gebruikt om de humiFog te berekenen doormiddel van een gestuurd proces en om alle componenten te selecteren die benodigd zijn om aan de eisen van de toepassingen van de klant te kunnen voldoen:

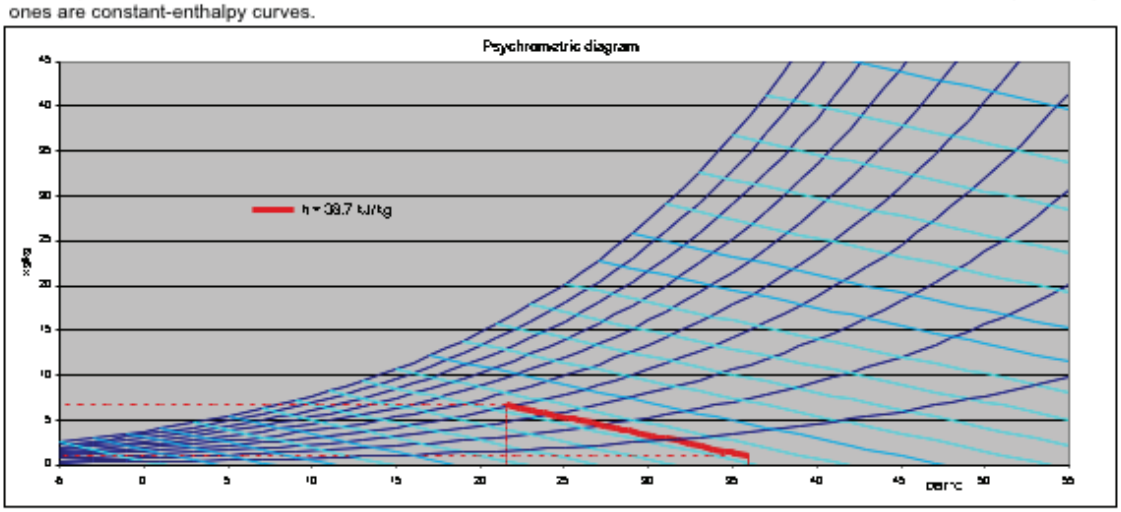
CAREL humiFog calculation sheet ver 3.2 — **AHU D06 D09**

RULES Input: cyan cells - Output: beige cells

Altitude a.s.l.	0	m

Air before humiFog			Air after humiFog		
Relative humidity	2,6%	%1 rH	Relative humidity	41,5%	%2 rH
Temperature	36,0	t1 °C	Temperature	21,6	t2 °C
Specific humidity	1,0	x1 g/kg	Specific humidity	6,7	x2 g/kg
			Difference x2-x1	5,7	g/kg

The diagram below shows the adiabatic transformation in red. Blue lines represent curves at a fixed relative humidity, while cyan ones are constant-enthalpy curves.

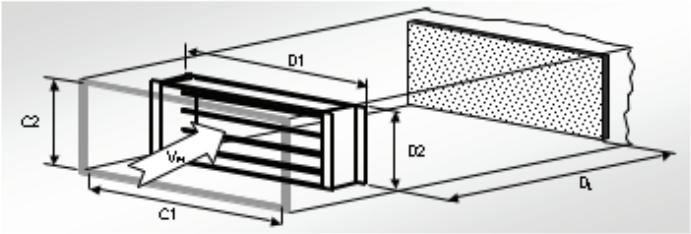


(1) Saturation efficiency is estimated to be — η — 64%

(1) Is the ratio between the required difference of specific humidity and the difference to achieve saturation Area humidity 100% rH.

Duct

Internal width C1	1925	mm
Internal height C2	2500	mm
Distance nozzle - drop separator DL	1750	mm
Air flow V	51.000	m^3/h
Air flow GA	58.219	kg/h
Air speed	2,94	m/sec



Water flows

Water to be absorbed Gv	kg/h	345,9
(2) Absorbtion efficiency	ε	95%

(2) Is the estimated ratio between the water absorbed by the air and the sprayed water.

Total water flow Gw — 364,2 kg/h

Een van de twee sectie waar de kast in is verdeeld wordt als volgt uitgerust met:

Benaming	Code	Omschrijving	
LBK D06 D09	UA500HD111	Pomp station + regelaar + Frequentie regelaar – 230 V – 50 Hz	
		Capaciteit (kg/h)	500
		Pomp materiaal	AISI316
		Demper	Ja
	Rek	Vernevelrek met manifolds, solenoeid afsluiters en verstuivers	
		Aantal solenoid afsluiters	7
		Aantal verstuivers	92
		Type verstuiver MTP	2
		Breedte (mm)	1762
		Hoogte (mm)	2332
		Afstand tussen druppelvanger en verstuivers	1750
	Druppelvanger		
	UAKT1000000 kit L=2,0 m met verloopstuk		

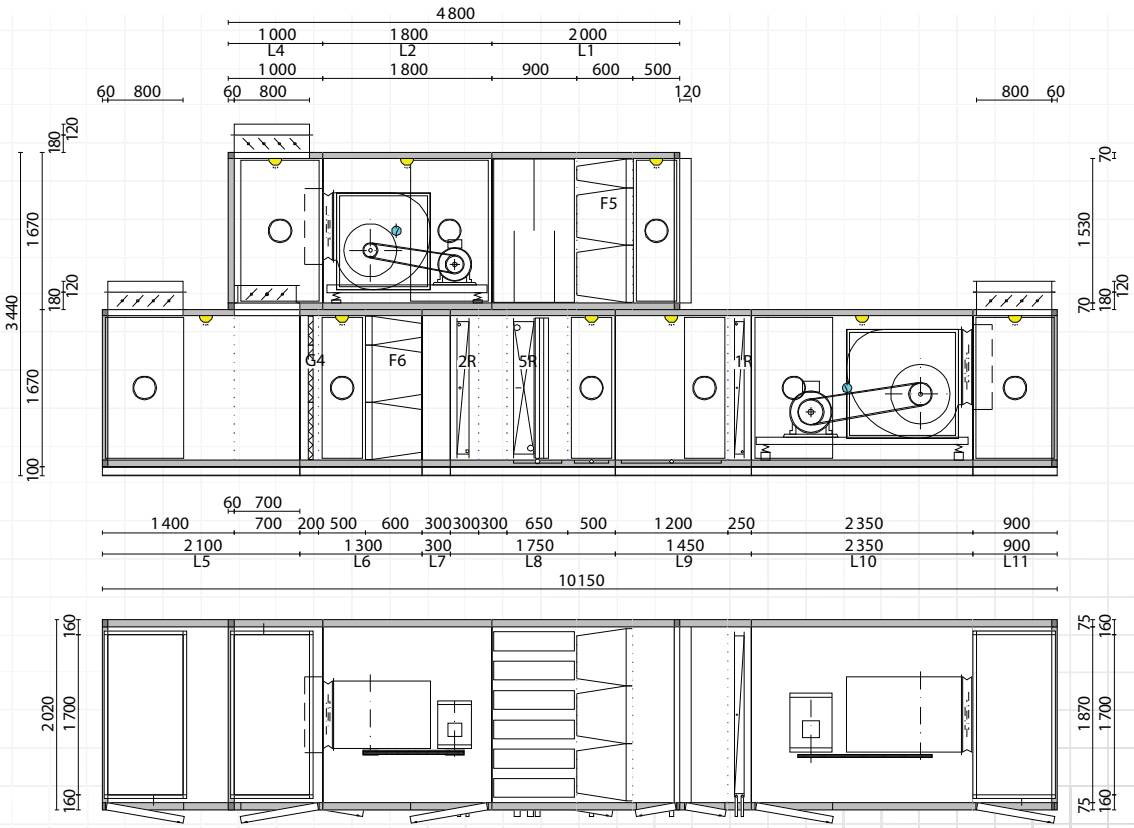
Luchtbehandelingskast D11 tot en met D13

Deze drie kasten zijn kleiner dan degene die hiervoor beschreven zijn, met een luchtverplaatsing van 26.500 m³/h. De buitenlucht wordt gemengd met de retourlucht waardoor de condities voor de bevochtiger uitkomt op 22 °C - 27,5% rv waardoor de lucht relatief koel en bevochtigd is. Voor de bevochtiger kan de lucht worden voorverwarmd tot de ingestelde temperatuur. Het ontwerp is als volgt:

Ontwerp gegevens:

Lucht voor de bevochtiger	22,0 °C	27,5% rv	4,5 g/kg	
Lucht na de bevochtiger	14,5 °C	72,5% rv	7,5 g/kg	
Lucht verplaatsing	26.500 m³/h	Berekend met het humiFog calculatieprogramma versie 3.2 zie volgende pagina		
Vereiste capaciteit	116,6 kg/h			

Afmetingen van de units D11 – D13



Gebruik van het "humiFog calculatieprogramma versie 3.2" geeft:

CAREL humiFog calculation sheet ver 3.2

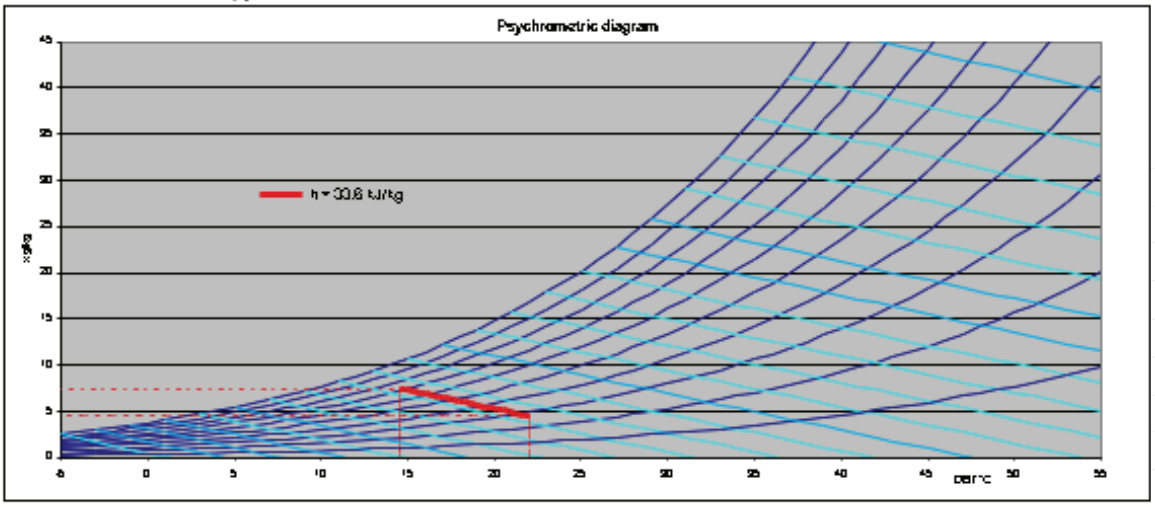
AHU D11 D13

RULES Input: cyan cells - Output: beige cells

Altitude a.s.l. 0 m

Air before humiFog			Air after humiFog		
Relative humidity	27,5%	%1 rH	Relative humidity	72,5%	%2 rH
Temperature	22,0	t1 °C	Temperature	14,5	t2 °C
Specific humidity	4,5	x1 g/kg	Specific humidity	7,5	x2 g/kg
			Difference x2-x1	3,0	g/kg

The diagram below shows the adiabatic transformation in red. Blue lines represent curves at a fixed relative h
ones are constant-enthalpy curves.

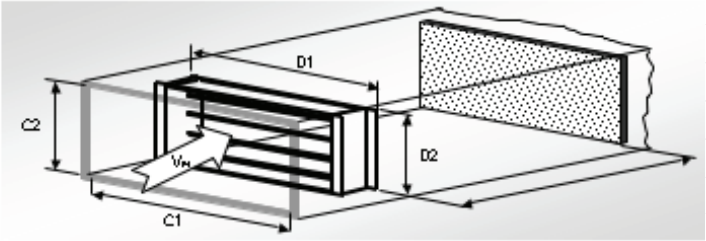


(1) Saturation efficiency is estimated to be η 73%

(1) Is the ratio between the required difference of specific humidity and the difference to achieve saturation (relative humidity 100% rH).

Duct

Internal width C1	1870	mm
Internal height C2	1530	mm
Distance nozzle - drop separator DL	1700	mm
Air flow V	26.500	m^3/h
Air flow GA	31.506	kg/h
Air speed	2,57	m/sec



Water flows

Water to be absorbed Gv	kg/h	96,2
(2) Absorbtion efficiency	ε	83%

(2) Is the estimated ratio between the water absorbed by the air and the sprayed water.

Total water flow Gw 116,6 kg/h

Hieruit volgt:
de lucht in de units D11 – D13 worden door een humiFog op de volgende manier bevochtigd

Benaming	Code	Omschrijving	
LBK D11 D13	UA120HD111	Pomp station + regelaar + Frequentie regelaar – 230 V – 50 Hz	
		Capaciteit (kg/h)	120
		Pomp materiaal	AISI316
		Demper	Ja
	Rek	Vernevelrek met manifolds, solenoeid afsluiters en verstuivers	
		Aantal solenoid afsluiters	3
		Aantal verstuivers	31
		Type verstuiver MTP	2
		Breedte (mm)	1762
		Hoogte (mm)	1420
		Afstand tussen druppelvanger en verstuivers	1700
	Druppelvanger		
	UAKT1000000 kit L=2,0 m met verloopstuk		

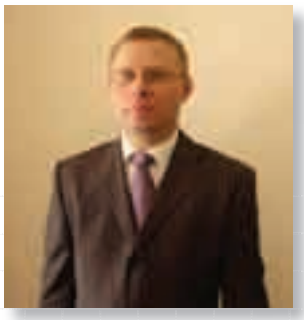
Conclusie

De 18 luchtbehandelingskasten worden bevochtigd door 24 humiFog systemen, geregeld door het GBS die het gehele luchtconditioneringsysteem van de drukkerij regelt. De totale bevochtigingcapaciteit is 6120 kg/h.

De ingestelde bevochtigings punten werden bereikt in overeenstemming met de gestelde eisen.

De order was gegund dankzij de actieve samenwerking met het CAREL hoofdkwartier in Italië en Alfaco Polska, de exclusieve CAREL distributeur in Polen met de heer Franciszek Klimosz (Sales Manager),

Deze aanzienlijke bijdrage stelde de klant tevreden, zowel door een uitstekend product in termen van kwaliteit en betrouwbaarheid maar ook door het vinden van een betrouwbare partner in CAREL voor industriële bevochtiging toepassingen in de grafische industrie.



Franciszek Klimosz - Director Alfaco Polska

Headquarters ITALY

CAREL S.p.A.
Via dell'Industria, 11 - 35020 Brugine - Padova (Italy)
Tel. (+39) 0499 716611 - Fax (+39) 0499 716600
carel@carel.com - www.carel.com

+402200240 - 1.0 - 03.11.2008

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