GREENHOUSE AIR HANDLING UNIT

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01

High Humidity in Greenhouse

Why is Humidity Important?

Evaporation is the most important way for a plant to lose heat.

Vapor pressure deficit (VPD) is an indicator of the condensation potential because it quantifies how close the greenhouse air is to saturation; in other words, describing how dry the air is at a given moment.

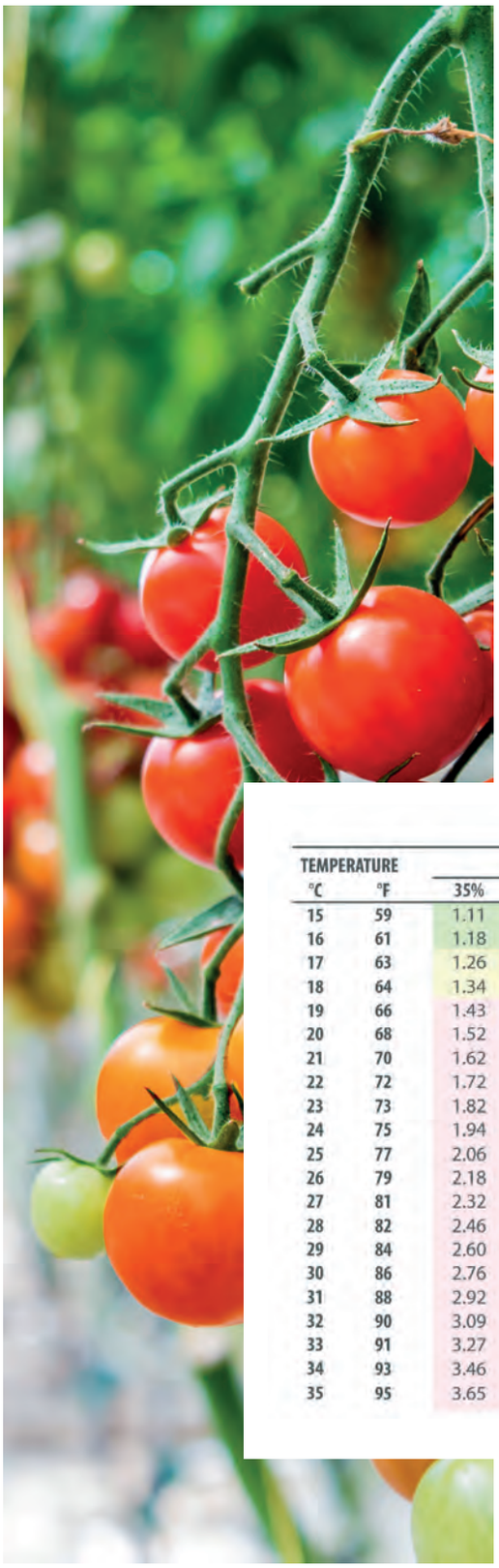
The amount of water vapor in the air is called “vapor pressure”. VPD defines how much more room there is in the air for more water vapor. The “deficit” is the difference between the evaporation pressure of water on the leaf surface and the partial vapor pressure of the air value.

Is humidity a problem?

Relative humidity levels effect when and how plants open the stomata on the undersides of their leaves. When the weather is warm, the plant close their stomata to reduce water losses.

Plants use stomata to transpire, in other words to breathe. When ambient conditions are too warm for plants and their stomata is closed for too long in an effort to conserve water, it has no way to move carbon dioxide and oxygen molecules. This causes the plant to suffocate on water vapor and its own transpired gases.

Vapor Pressure Deficit



Evaporation -from soil- and transpiration -from the crop stomata- occur simultaneously. The driving factor of evaporation from a crop soil is mainly determined by the fraction of the solar radiation reaching the surface, besides temperature, and vapor pressure gradients.

The speed at which transpiration occurs is determined by heat, carbon dioxide levels, light and water. Inside the leaves of each plant, the atmospheric humidity is 100%. The extent to which the stomata open up is to a certain degree determined by the RH differences between the air surrounding the leaves and the RH levels inside.

If the stomata are extremely open and the surrounding cells are no longer able to make up for water lost due to evaporation, water stress will occur. If the plant loses too much water, the stomata will close with the result that photosynthesis stops.

Perfect Grower Vapor Pressure Deficit Recommendations (kPa)

TEMPERATURE		Relative Humidity													
°C	°F	35%	40%	45%	50%	55%	60%	65%	70%	75%	80%	85%	90%	95%	100%
15	59	1.11	1.02	0.94	0.85	0.77	0.68	0.60	0.51	0.43	0.34	0.26	0.17	0.09	0
16	61	1.18	1.09	1.00	0.91	0.82	0.73	0.64	0.55	0.45	0.36	0.27	0.18	0.09	0
17	63	1.26	1.16	1.06	0.97	0.87	0.77	0.68	0.58	0.48	0.39	0.29	0.19	0.10	0
18	64	1.34	1.24	1.13	1.03	0.93	0.83	0.72	0.62	0.52	0.41	0.31	0.21	0.10	0
19	66	1.43	1.32	1.21	1.10	0.99	0.88	0.77	0.66	0.55	0.44	0.33	0.22	0.11	0
20	68	1.52	1.40	1.29	1.17	1.05	0.93	0.82	0.70	0.58	0.47	0.35	0.23	0.12	0
21	70	1.62	1.49	1.37	1.24	1.12	0.99	0.87	0.75	0.62	0.50	0.37	0.25	0.12	0
22	72	1.72	1.59	1.45	1.32	1.19	1.06	0.92	0.79	0.66	0.53	0.40	0.26	0.13	0
23	73	1.82	1.68	1.54	1.40	1.26	1.12	0.98	0.84	0.70	0.56	0.42	0.28	0.14	0
24	75	1.94	1.79	1.64	1.49	1.34	1.19	1.04	0.89	0.75	0.60	0.45	0.30	0.15	0
25	77	2.06	1.90	1.74	1.58	1.42	1.27	1.11	0.95	0.79	0.63	0.47	0.32	0.16	0
26	79	2.18	2.02	1.85	1.68	1.51	1.34	1.18	1.01	0.84	0.67	0.50	0.34	0.17	0
27	81	2.32	2.14	1.96	1.78	1.60	1.43	1.25	1.07	0.89	0.71	0.53	0.36	0.18	0
28	82	2.46	2.27	2.08	1.89	1.70	1.51	1.32	1.13	0.94	0.76	0.57	0.38	0.19	0
29	84	2.60	2.40	2.20	2.00	1.80	1.60	1.40	1.20	1.00	0.80	0.60	0.40	0.20	0
30	86	2.76	2.54	2.33	2.12	1.91	1.70	1.48	1.27	1.06	0.85	0.64	0.42	0.21	0
31	88	2.92	2.69	2.47	2.24	2.02	1.80	1.57	1.35	1.12	0.90	0.67	0.45	0.22	0
32	90	3.09	2.85	2.61	2.38	2.14	1.90	1.66	1.43	1.19	0.95	0.71	0.48	0.24	0
33	91	3.27	3.02	2.76	2.51	2.26	2.01	1.76	1.51	1.26	1.01	0.75	0.50	0.25	0
34	93	3.46	3.19	2.92	2.66	2.39	2.13	1.86	1.59	1.33	1.06	0.80	0.53	0.27	0
35	95	3.65	3.37	3.09	2.81	2.53	2.25	1.97	1.69	1.40	1.12	0.84	0.56	0.28	0

VPD influences five key factors;

Stomata Opening

As VPD increases, stomata get smaller.

CO_2 uptake

As VPD increases and stomata get smaller, CO2 uptake gets reduced.

Transpiration

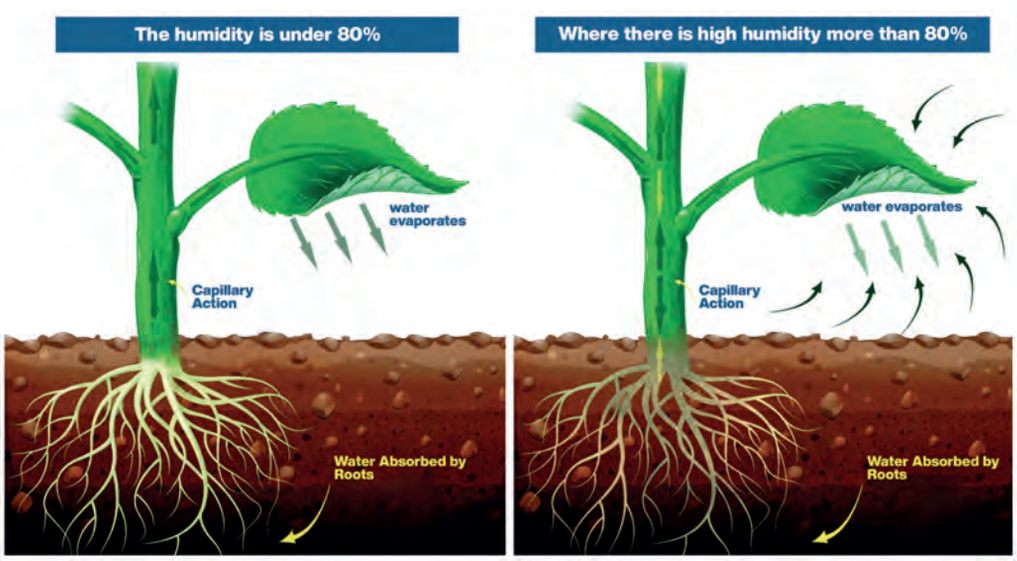
As VPD increases, the plant transpires faster. Low VPD, meaning low transpiration, would cause plant metabolism to slow down, inhibiting development, while also increasing susceptibility to diseases.

Nutrient intake at the roots

As VPD increases, and transpiration increases, the roots pull in more nutrients.

Plant stress

As VPD increases, the plant goes on the defense, in an effort to retain water. The stomata close to prevent evaporation, stopping the intake of CO2 and impeding growth. Using relative humidity values comes in short if and when the air temperatures change significantly.



VPD is an important driver of atmospheric water demand for plants and getting the VPD right will give the best results in grow.

Greenhouse Air Handling Unit

VPD-Based Air Handling Unit with Standalone Automation.

Understanding VPD and its impact on plant development and resource utilization is essential for grower to optimize yields and costs.

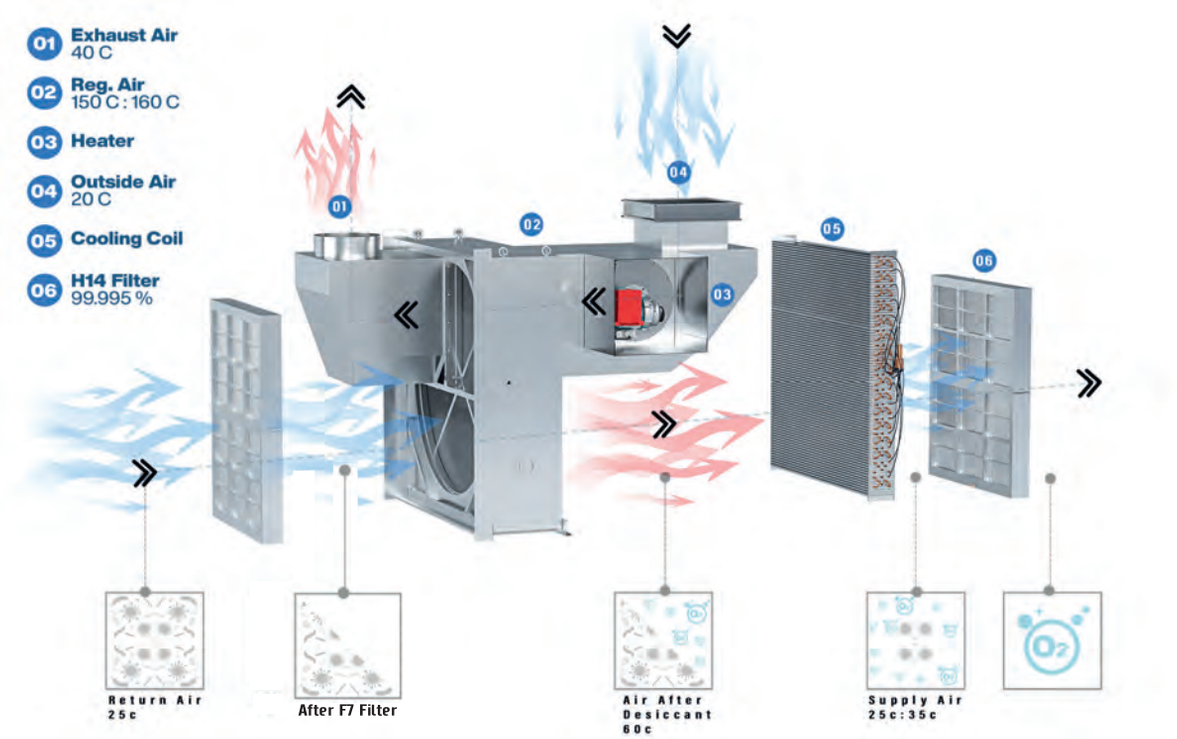
Timfog's GAHU determines necessary changes with its own automation, a special VPD algorithm enabling the healthiest environment and ultimately maximizing plant growth and health.

It provides a more accurate indication of the current evaporation potential since it combines the effects of both temperature and humidity into a single value.

03

Greenhouse Air Handling Unit
GAHU

The process consists of a state-of-the-art desiccant rotor and a burner. Water vapor is removed from the air through the rotor and air with low moisture density is released in the greenhouse. Thus, the air inside is heated at the same time.



The system is predicated on the principle of taking and heating the air with the help of the rotor. The desiccant wheel rotates, changing its surfaces between the regeneration zone and the process air. In here, the rotor is heated by the regeneration air so that the humid air is dried and resent to the relevant site-eliminating fungi, bacteria and viruses in the process, distributing homogeneous air for cooling, heating, dehumidifying and ventilation. When the air in the greenhouse is warmer than necessary, GAHU's cooling mode is activated, maintaining the temperature at desired levels. GAHU decides on these processes with the data, it receives from the greenhouse and external environment.

When high constant temperature is required, PID provides the desired constant temperature value. In addition, the specific humidity of the air passing through the drum is continuously calculated by GAHU's automation system, beginning with the first start of the burner and a periodic follow-up at constantly increasing temperatures.


Royal Vine
Royal Vine
Royal Vine
Harvest of health
get balanced by nature...

03

Greenhouse Air Handling Unit
GAHU

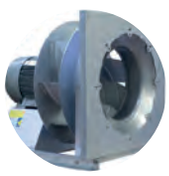
Regeneration Air Exhaust Fan

The Regeneration Air Exhaust Fan incorporates a heavy-duty air handling impeller and is designed for handling vapor exhaust.

The impeller is constructed with heavy-gauge blades welded to both back plate and front ring.

Regeneration Exhaust Box

Regeneration Exhaust Box made of stainless steel and covered with high levels of mechanical resistance rock wool insulation.

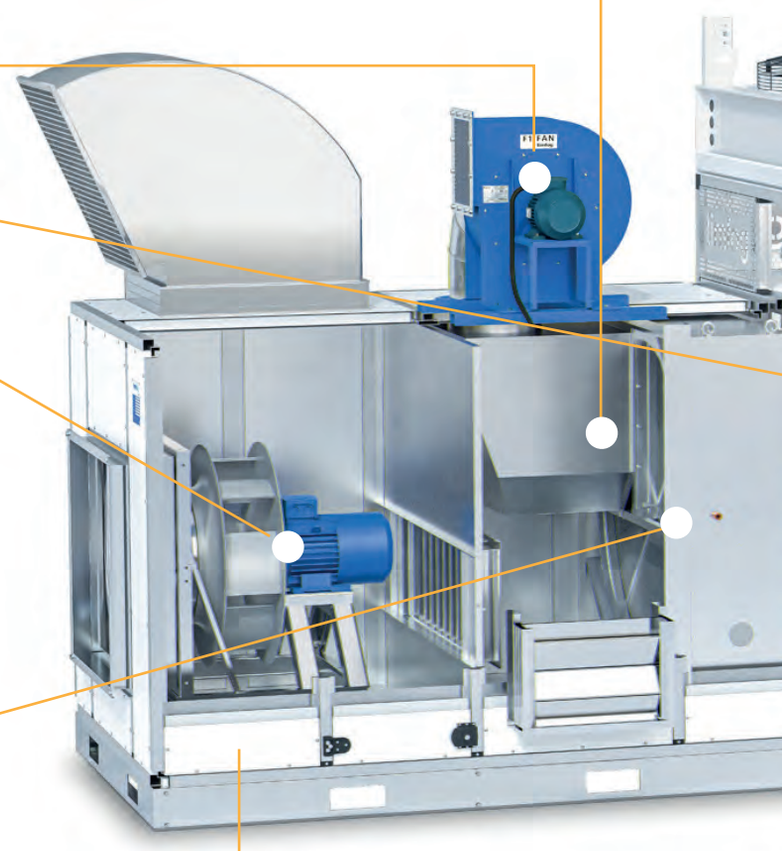


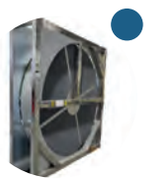
Air Supply & Exhaust Fan

Free-running impeller with 7 backward-curved blades Impeller made of sheet steel with surface protection provided by powder coating.

The impeller with rotating, non-fluted diffusor for high-efficiency levels and favorable acoustic characteristics.

The impeller made of aluminum and used with external rotor motors.





Desiccant Rotor

The rotor is a cylinder filled with alternately flat and wave-shaped thin walls of a desiccant, usually silica gel or molecular sieve, forming a matrix of narrow channels through the length of the cylinder.

The desiccant can attract and adsorb the water vapor so the air that pass into those channels at one end of the cylinder will exit as dry air at the opposite side.

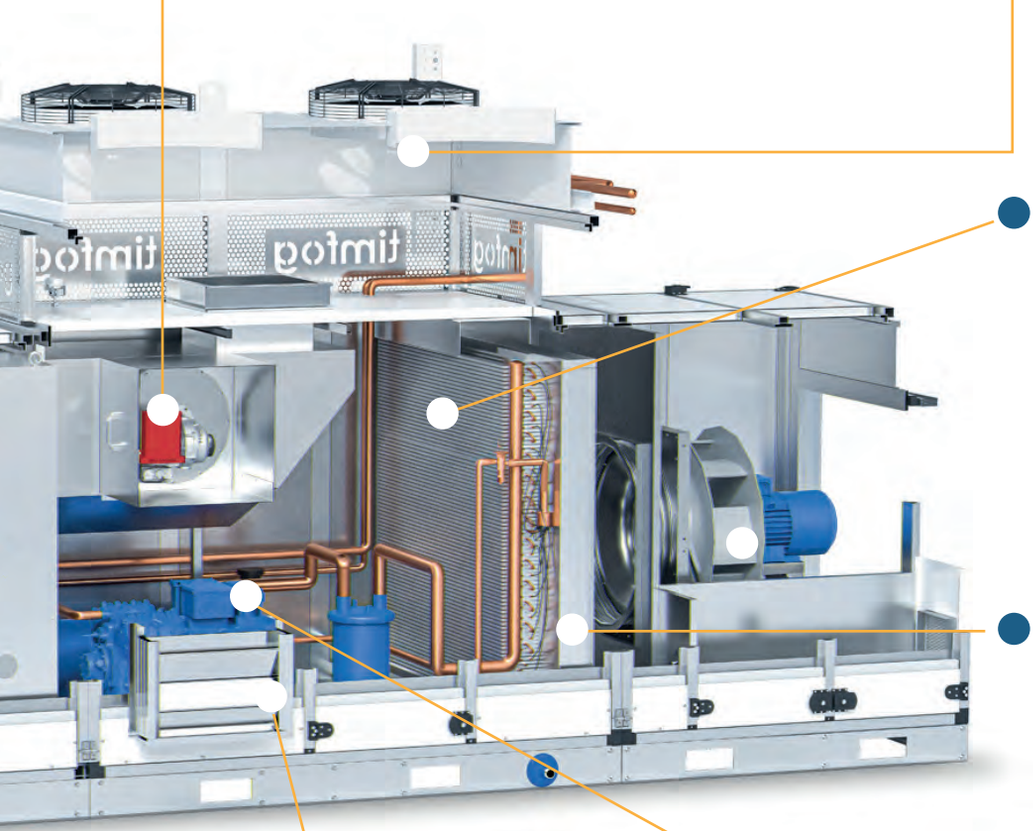
Body & Insulation

The body has its own chassis, carrying holes and hangers.

For both panels and service doors, the inner body is galvanized sheet metal, and the outer body is made of painted sheet metal.

Rock wool with a thickness of 50 mm and a density of 70 kg/m3 is used for thermal and sound insulation.

Specially designed gaskets are used in the body to prevent leaks.



Burner & Combustion Chamber

Combustion Chamber made of stainless steel and covered with high levels of mechanical resistance rock wool insulation.

In this combustion chamber, the air is heated up to temperature of 160 °C and it's purified from harmful bacteria and microorganisms in the air.

Condenser

Grooved copper tubes special for condensers. Fins made of aluminum.

Epoxy polyester-based electrostatic powder coated galvanized steel is used as the casing material, which provides excellent UV and corrosion protection.

High efficiency ZIEHL-ABEGG, EBM or equivalent fans with diameters of 500 mm, 630 mm, 800 mm, 910 mm are used in the suction direction of the condensers.

Cooling Coil

Copper tube - aluminum fin type high efficiency coils. A distributor is used for homogeneous refrigerant distribution at the coil inlet.

There is a condensation pan made of stainless steel under the cooling coil.

Mist Eliminator

Mist Eliminator provides high efficiency droplet separation and low pressure drop, even at high face velocity.

Dampers

The damper frames and blades are made from extruded aluminum profiles.

The blades move in polymeric bearings in parallel by a rod linkage mechanism.

The blades have rubber gaskets for tight shut-off.

Compressor

Semi-hermetic compressor with built-in electric motor, part winding starting (PWS) and thermal protection probes connected to the electronic control module.

GAHU

with Compressor & Desiccant

GAHU with Compressor & Desiccant can be controlled proportionally with the fresh air and the inverter fans used on the blowing air side. It performs the humidity and temperature control in the greenhouse completely automatically. With digital control, the ambient air humidity and temperature are controlled precisely.

It provides the heating of the greenhouse with the hot air it produces during the winter season. It has a low energy consumption, it cleans and filters the air. It purifies a significant part of the bacteria in the greenhouse, helps to prevent diseases that will greatly reduce plant yield in enclosed areas such as greenhouses or seedlings. It also helps 90% of disease and sports prevention, It does not contain any chemicals and its dehumidification and heating process is completely organic. With its compact exterior dimensions, it can be easily placed just outside the greenhouse.

The system is based on the principle of absorbing the humid air and heating with the aid of a solid zeolite dehumidifier rotor and a blower burner. Then cooling coils in GAHU decrease the temperature and dehumidify the air for the second time.

GAHU with Compressor & Desiccant which can reach 400 lt / h dehumidification capacity in a single device when required, can be used comfortably in very large seedling or greenhouse area thanks to the advantages of communicating with multiple units and being centrally monitored and controlled. Together with fresh air, it will absorb humid air in the greenhouse.

Hygiene Mode

Mobile Control Panel

Humidifying Options

Filter Options

Adjustible and Effective Air Velocity

Summer or Winter Operation Options

Homogeneous Ventilation

Key Features

- Compact unit - easy assembly
- Optional hygiene mode, plus HEPA filters
- VPD based precise digital control and automation
- Low energy consumption
- Better yield quality and quantity
- Full integration to universal greenhouse automation systems
- Capability of being monitored and controlled remotely

Low Energy Consumption

Easy Assembly

Certification and Testing

Timfog's quality management system is ISO 9001 certified, ensuring ongoing compliance, meaning that the customer requirements are identified and that the design of the product meets the requirements.

Timfog GAHU devices are tested against conformity with the technical requirements of 2006/42/EC and 2014/35/EU by an independent 3rd party. The devices are always tested before leaving the factory to ensure trouble-free operation. This ensures reliable performance in the field.

ISO 9001:2015

CE

GAHU
with Desiccant

GAHU with Desiccant can also be controlled proportionally with the fresh air and the inverter fans used on the blowing air side. It performs the humidity control in the greenhouse completely automatically.

It contains only the desiccant rotor component. Therefore it has the lowest energy consumption compared to other GAHU models. Natural gas supply is required for its use. Natural gas tubes or local gas distribution systems can be preferred.

It is not suitable for use in summer because it absorbs moisture by heating the air.

With the hygiene mode, it purifies the air from harmful micro-organisms in the greenhouse. GAHU with Desiccant's anti-bacterial performance is 99.9%.

Low Energy Consumption

Easy Assembly

Hygiene Mode

Mobile Control Panel

Humidifying Options

Filter Options

Adjustible and Effective Air Velocity

Natural Gas Burner

Homogeneous Ventilation

GAHU
with Compressor

GAHU with Compressor can also be controlled proportionally with the fresh air and the inverter fans. It performs the humidity control in the greenhouse completely automatically.

GAHU with Compressor runs only with the cooling coil inside. For this reason, it can operate without the requirement for any natural gas connection. Only electricity supply is enough to use this device.

It is suitable for both use in summer or winter as it absorbs moisture by cooling the air.

The maximum dehumidification capacity can reach 290 kg/h.

Hygiene mode cannot be used in this model of GAHU, because there is no burner or regeneration air inside.

Low Energy Consumption

Easy Assembly

Mobile Control Panel

Humidifying Options

Filter Options

Adjustible and Effective Air Velocity

Summer or Winter Operation Options

Homogeneous Ventilation

With medical grade cannabis, stability and uniformity is the key to success.

During the first two hours of blackout, 1000 square meters of cannabis can transpire up to 200 liters of vapor into the air.

If not managed properly results can be devastating. A cultivation system must be designed for the sole purpose of creating the ultimate growing environment where the plants can flourish.

In all stages of cannabis growth your plants will have a constant need to intake water, and the amount of water they need fluctuates with the humidity in your grow room. When the humidity is high, cannabis plants use their leaves to absorb moisture from the air which causes them to drink less water from their roots. Conversely, when the humidity is low, they will pull more water in through their roots.

Since humidity changes how much water your plants drink, and the water you give your plants have nutrients in them, being in control of humidity gives you increased control over your plant's nutrient intake.

OPTIMAL HUMIDITY			
Clones 70%	**Vegetative** 40-60%	**Flowering** 40-50%	**Final Weeks of Flowering** 40-45%

* Too-high humidity can lead to slow growth, mold and bud rot (especially on leafy plants or fat buds). Too-low humidity causes slow growth and leaf stress.

Indoor Humidity Control for Cannabis Plants

Most growers will struggle to keep both relative humidity and temperatures down, which is of primary importance in the flowering period. In some colder regions, and depending on the lighting solution, the opposite scenario might be the case, and temperatures or humidity levels must be raised.

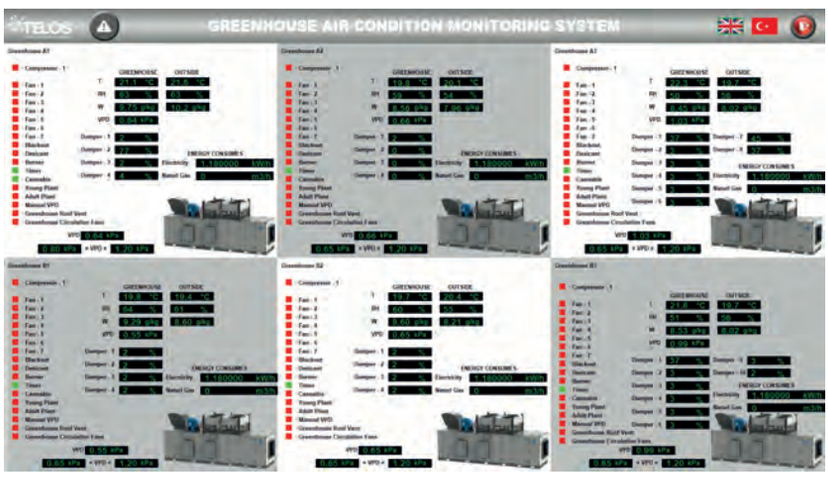
However, overly moist conditions can also be harmful to plants, especially cannabis, and puts them at risk of developing bud rot and other diseases as water builds up in the thick foliage and creates the perfect environment for bacteria and fungi.

Cannabis Mode

There are 4 operation modes and every mode has a seperate clear and easy to understand screen, including general screens that allow users to check the device at a glance and dedicated screens to find faults or root casues along, or to evaluate historical data.

In operation modes, there is a blackout scenario specifically for the cannabis mode. GAHU detects when a blackout scenario is triggered by the greenhouse's automation system via top screen closing, and adjusts its performance for the plants' needs due to the light deprivation they are exposed to.

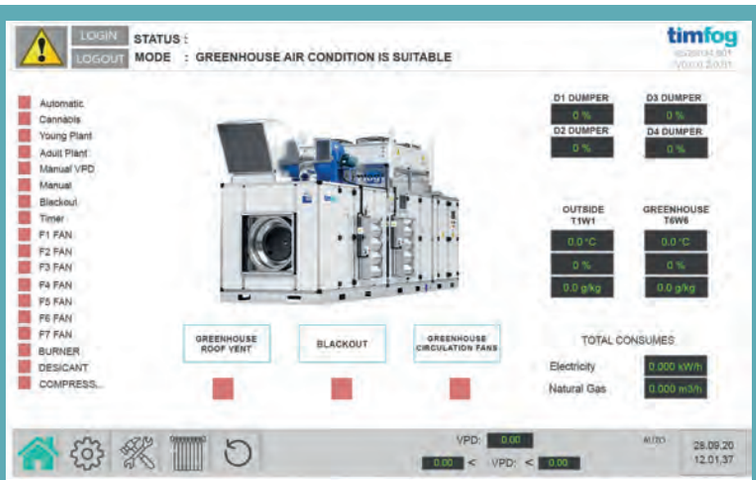
OTHER OPERATION MODES



Manual Mode

Adult Plant Mode

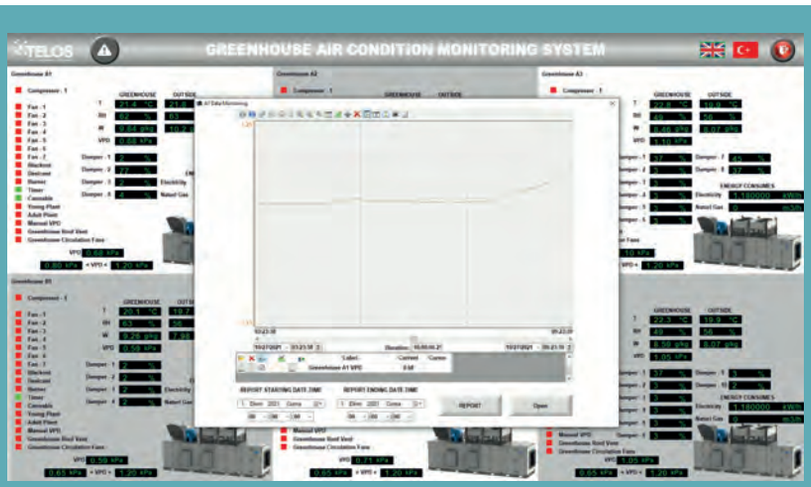
Young Plant Mode



GAHU devices have a preinstalled, preconfigured and fully integrated control system with a wall-mounted control panel.

The user friendly system allows users to choose and set functions and parameters with the built-in Human Machine Interface (HMI).

The built-in automation panel, full automatic VPD based control, depending on the return air, supply air, outside air temperatures and humidity, is ensured.



The operating modes, operating data, operating status, operating time settings, alarms, scenario, parameter, and system settings, air handling unit details, energy analyzer, and energy consumption details are displayed via various screens.

	Timfog - by compressor, burner, desiccant wheel **GAHU 15-150/250-NG**	**Timfog –** only by compressor **GAHU 15-150/100**	**Competitor 1**	**Competitor 2**
Effective usage during summer	✓	✓	✓	✗
Effective usage during winter	✓	✓	✓	✓
Vapor Pressure Deficit control	✓	✓	✗	✗
Hygene mode availability	✓	✗	✗	✗
Integrated operation feature w/ other gh systems	✓	✓	✗	✗
Control feature via mobile phone or tablet	✓	✓	✓	✗
Dehumidification by cooling in summer & heating in winter	✓	✓	✗	✗
Connection availability to liquid CO_2 line (to give CO_2 into the greenhouse through the plant)	✓	✓	✗	✗
Ability to use outside air thermodynamics	✓	✓	✗	✗
Initial investment cost (summer period study data)	100,0€	84,1 €	135,7 €	-
Operating cost (summer period study data)	100,0€	100,5€	119,2 €	-
Initial investment cost (winter period study data)	100,0€	93,1 €	126,6 €	126,4 €
Operating cost (winter period study data)	100,0€	168,5€	187,5 €	93,2 €

05 Greenhouse Air Handling Unit
Technical Details - Natural Gas or LNG

MODEL NR. STOCK NR.	**GAHU2 50/120-NG** 2,001,014,007	**GAHU5 50/120-NG** 2,001,014,008	**GAHU10 100/180-NG** 2,001,014,009	**GAHU15 150/250-NG** 2,001,014,010	**GAHU20 200/390-NG** 2,001,014,011	**GAHU25 200/390-NG** 2,001,014,012
MODEL NAME	GAHU with NG/ LNG Burner dried desiccant wheel and cooling coil proportionally controlled incl. fresh air intake	GAHU with NG/ LNG Burner dried desiccant wheel and cooling coil proportionally controlled incl. fresh air intake	GAHU with NG/ LNG Burner dried desiccant wheel and cooling coil proportionally controlled incl. fresh air intake	GAHU with NG/ LNG Burner dried desiccant wheel and cooling coil proportionally controlled incl. fresh air intake	GAHU with NG/ LNG Burner dried desiccant wheel and cooling coil proportionally controlled incl. fresh air intake	GAHU with NG/ LNG Burner dried desiccant wheel and cooling coil proportionally controlled incl. fresh air intake
GENERAL PURPOSE	Dehumidification, Heating, Cooling	Dehumidification, Heating, Cooling	Dehumidification, Heating, Cooling	Dehumidification, Heating, Cooling	Dehumidification, Heating, Cooling	Dehumidification, Heating, Cooling
REGENERATION	Natural Gas Burner	Natural Gas Burner	Natural Gas Burner	Natural Gas Burner	Natural Gas Burner	Natural Gas Burner
1 SUPPLY AIR FLOW (m^3/h)	1800 / 3500	5000 / 10.000	9000 / 15000	14000 / 22000	18000 / 30000	23000 / 35000
REGENERATION AIR FLOW (m^3/h)	660	1700	3000	4700	6000	7700
2 COOLING POWER (kw)	27,97	55,94	115,94	173,91	215,37	215,37
3 HEATING POWER (kw)	9,57	23,92	47,84	71,76	95,68	119,61
4 NOMINAL DEHUMIDIFYING CAPACITY (kg/h)	21	60	90	132	180	210
5 DEHUMIDIFICATION SYSTEM CAPACITY MAX (kg/h)	25,92	72	129,6	201,6	259,2	331,2
6 AVERAGE ENERGY CONSUMPTION (WINTER)	8,2 kW + 1,52 m^3/h Natural Gas	9,6kW - 3,79m3/h Natural Gas	18,4 kW + 7,58 m^3/h Natural Gas	85,8 kW + 26,5 m^3/h Natural Gas	54,2 kW + 12,89 m^3/h Natural Gas	63,8 kW + 16,11 m^3/h Natural Gas
7 AVERAGE ENERGY CONSUMPTION (SUMMER)	14,4 kW + 1,29 m^3/h Natural Gas	18,2 kW + 3,22 m^3/h Natural Gas	33,4 kW + 6,44 m^3/h Natural Gas	46,3 kW + 9,67 m^3/h Natural Gas	54,2 kW + 12,89 m^3/h Natural Gas	63,8 kW + 16,11 m^3/h Natural Gas
8 DEVICE INSTALLED POWER	31,2 kW + 12,7 m^3/h Natural Gas	34,3 kW + 12,7 m^3/h Natural Gas	60,2 kW + 19,2 m^3/h Natural Gas	85,8 kW + 26,5 m^3/h Natural Gas	91,7 kW + 41,5 m^3/h Natural Gas	116 kW + 41,5 m^3/h Natural Gas
COEFFICIENT OF PERFORMANCE (COP)	3,16	3,16	3,19	3,19	3,22	3,22
ENERGY EFFICIENCY RATIO (EER)	10,78	10,78	10,88	10,88	10,99	10,99

Greenhouse Air Handling Unit
Technical Details - Desiccant

05

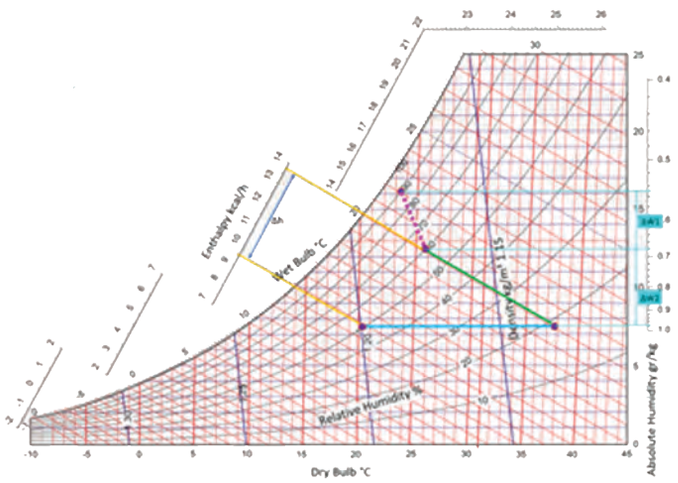
MODEL NR. STOCK NR.	GAHU2 120-NG 2,001,014,001	GAHU5 120-NG 2,001,014,002	GAHU10 180-NG 2,001,014,003	GAHU15 250-NG 2,001,014,004	GAHU20 390-NG 2,001,014,005	GAHU25 390-NG 2,001,014,006
MODEL NAME	GAHU with NG/ LNG Burner dried desiccant wheel proportionally controlled incl. fresh air intake	GAHU with NG/ LNG Burner dried desiccant wheel proportionally controlled incl. fresh air intake	GAHU with NG/ LNG Burner dried desiccant wheel proportionally controlled incl. fresh air intake	GAHU with NG/ LNG Burner dried desiccant wheel proportionally controlled incl. fresh air intake	GAHU with NG/ LNG Burner dried desiccant wheel proportionally controlled incl. fresh air intake	GAHU with NG/ LNG Burner dried desiccant wheel proportionally controlled incl. fresh air intake
GENERAL PURPOSE	Dehumidification, Heating	Dehumidification, Heating	Dehumidification, Heating	Dehumidification, Heating	Dehumidification, Heating	Dehumidification, Heating
REGENERATION	Natural Gas Burner	Natural Gas Burner	Natural Gas Burner	Natural Gas Burner	Natural Gas Burner	Natural Gas Burner
1 SUPPLY AIR FLOW (m3/h)	1800	5000	9000	14000	18000	23000
REGENERATION AIR FLOW (m3/h)	600	1700	3000	4700	6000	7700
2 COOLING POWER (kw/h)	-	-	-	-	-	-
3 HEATING POWER (kw/h)	9,57	23,92	47,84	71,7	95,69	119,61
4 NOMINAL DEHUMIDIFYING CAPACITY (kg/h)	12,96	36	64,8	100,8	129,6	165,6
5 DEHUMIDIFICATION SYSTEM CAPACITY MAX (kg/h)	17,28	48	86,4	134,4	172,8	220,8
6 AVERAGE ENERGY CONSUMPTION (WINTER)	2,2 kW + 1,52 m^3/h Natural Gas	3,6 kW + 3,79 m^3/h Natural Gas	8,4 kW + 7,58 m^3/h Natural Gas	13,3 kW + 11,37 m^3/h Natural Gas	16,2 kW + 15,16 m^3/h Natural Gas	19,8 kW + 18,95 m^3/h Natural Gas
7 AVERAGE ENERGY CONSUMPTION (SUMMER)	-	-	-	-	-	-
8 DEVICE INSTALLED POWER	6,2 kW + 12,7 m^3/h Natural Gas	8,3 kW + 12,7 m^3/h Natural Gas	15,2 kW + 19,2 m^3/h Natural Gas	20,8 kW + 26,5 m^3/h Natural Gas	24,7 kW + 41,5 m^3/h Natural Gas	29 kW + 41,5 m^3/h Natural Gas
COEFFICIENT OF PERFORMANCE (COP)	-	-	-	-	-	-
ENERGY EFFICIENCY RATIO (EER)	-	-	-	-	-	-

05 Greenhouse Air Handling Unit
Technical Details - Compressor

MODEL NR. STOCK NR.	**GAHU2 50/33** 2,017,008,032	**GAHU5 50/33** 2,017,008,033	**GAHU10 100/66** 2,017,008,034	**GAHU15 150/100** 2,017,008,035	**GAHU20 200/133** 2,017,008,036	**GAHU25 200/133** 2,017,008,037
MODEL NAME	GAHU with cooling coil proportionally controlled incl. fresh air intake	GAHU with cooling coil proportionally controlled incl. fresh air intake	GAHU with cooling coil proportionally controlled incl. fresh air intake	GAHU with cooling coil proportionally controlled incl. fresh air intake	GAHU with cooling coil proportionally controlled incl. fresh air intake	GAHU with cooling coil proportionally controlled incl. fresh air intake
GENERAL PURPOSE	Dehumidification, Cooling	Dehumidification, Cooling	Dehumidification, Cooling	Dehumidification, Cooling	Dehumidification, Cooling	Dehumidification, Cooling
REGENERATION	Compressor	Compressor	Compressor	Compressor	Compressor	Compressor
[1] SUPPLY AIR FLOW (m3/h)	2000	5000	10000	15000	20000	25000
REGENERATION AIR FLOW (m3/h)	-	-	-	-	-	-
[2] COOLING POWER (kw)	27,97	55,94	115,94	173,91	215,37	215,37
[3] HEATING POWER (kw)	18,65	37,29	77,29	115,94	143,58	143,58
[4] NOMINAL DEHUMIDIFYING CAPACITY (kg/h)	14,4	36	72	108	144	180
[5] DEHUMIDIFICATION SYSTEM CAPACITY MAX (kg/h)	19,2	48	96	144	192	240
[6] AVERAGE ENERGY CONSUMPTION (WINTER)	-	-	-	-	-	-
[7] AVERAGE ENERGY CONSUMPTION (SUMMER)	22,4 kW	28,2 kW	43,4 kW	56,3 kW	64,2 kW	73,8 kW
[8] DEVICE INSTALLED POWER	31,2 kW	34,3 kW	60,2 kW	85,8 kW	91,7 kW	116 kW
COEFFICIENT OF PERFORMANCE (COP)	3,16	3,16	3,19	3,19	3,22	3,22
ENERGY EFFICIENCY RATIO (EER)	10,78	10,78	10,88	10,88	10,99	10,99

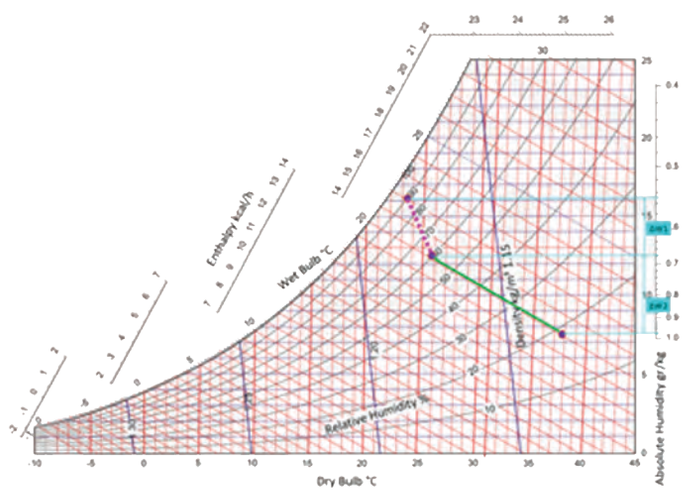
GAHU
with Compressor & Desiccant

$\Delta W1$	= IA_w - OA_w
$\Delta W2$	= OAw - Dw
ΔW_T	= $\Delta W1+\Delta W2$
ΔW_T	= Total dehumidification (kg/kg)
OA_w	= Outside air absolute humidity (kg/kg)
IA_w	= Inside air absolute humidity (kg/kg)
D_w	= Desiccant rotor outlet absolute humidity (kg/kg)
Cooling Capacity	= $\dot{m}.\Delta h$ (kcal/h)
$\dot{m}$	= Air volume (kg/h)
Δh	= Enthalpy differences (kcal/kg)



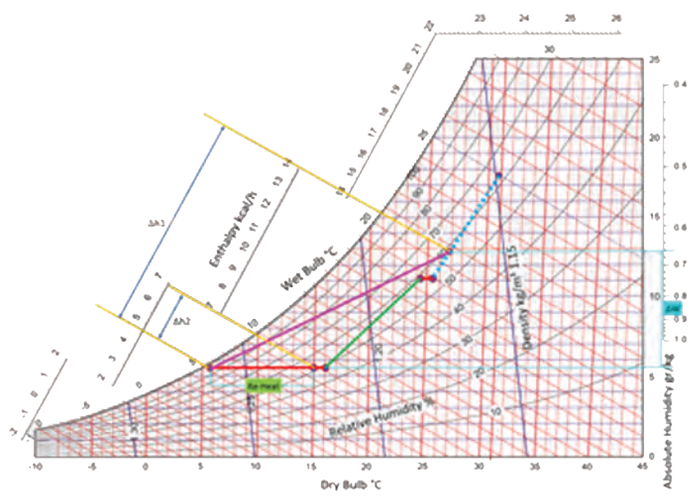
GAHU
with Desiccant

$\Delta W1$	= IA_w - OA_w
$\Delta W2$	= OAw - Dw
ΔW_T	= $\Delta W1+\Delta W2$
ΔW_T	= Total dehumidification (kg/kg)
OA_w	= Outside air absolute humidity (kg/kg)
IA_w	= Inside air absolute humidity (kg/kg)
D_w	= Desiccant rotor outlet absolute humidity (kg/kg)



GAHU
with Compressor

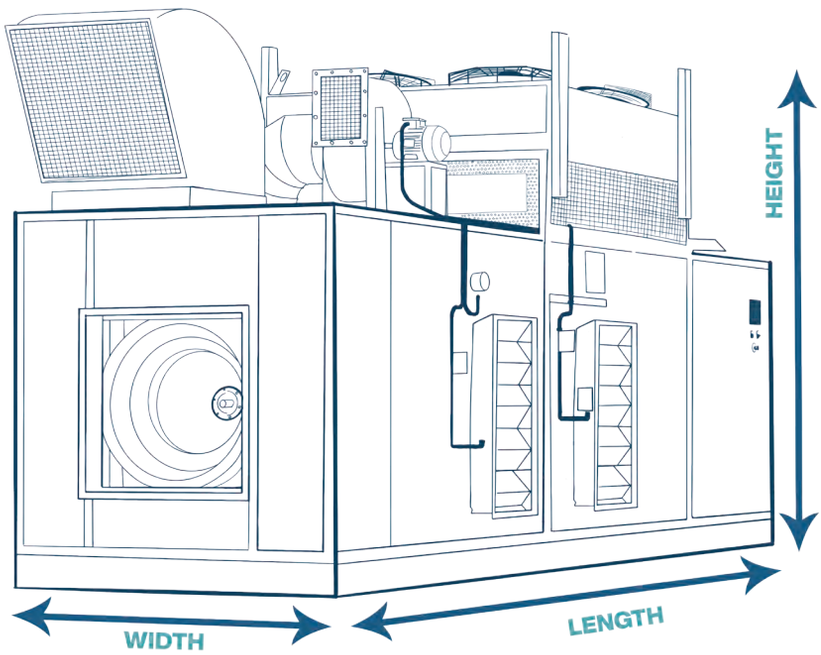
ΔW_T	= Total dehumidification (kg/kg)
Cooling Capacity	= $\dot{m}.\Delta h_1$ (kcal/h)
$\dot{m}$	= Air volume (kg/h)
Δh_1	= Enthalpy differences (kcal/kg)
Re-Heat Capacity	= $\dot{m}.\Delta h_2$ (kcal/h)
$\dot{m}$	= Air volume (kg/h)
Δh_2	= Enthalpy differences (kcal/kg)



06

Greenhouse Air Handling Unit

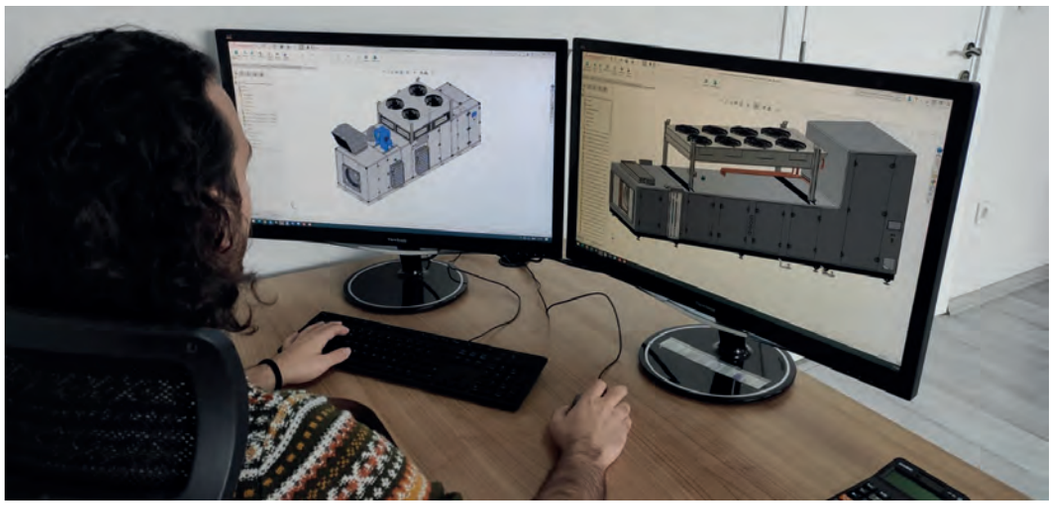
DIMENSIONS



		Width (mm)	Length (mm)	Height (mm)	Weight (kg)
1	**GAHU with Natural Gas or LNG**				
1.1	GAHU2-50/120-NG	900	5500	1900	1550
1.2	GAHU5-50/120-NG	1200	5800	2050	1750
1.3	GAHU10-100/180-NG	1500	6100	2350	2050
1.4	GAHU15-150/250-NG	1800	6300	2650	2470
1.5	GAHU20-200/390-NG	1800	6600	2650	2970
1.6	GAHU25-200/390-NG	2100	6850	2950	3440
2	**GAHU with Desicant Rotor**				
2.1	GAHU2-120-NG	900	4860	1250	1280
2.2	GAHU5-120-NG	1200	5180	1550	1510
2.3	GAHU10-180-NG	1500	5500	1950	1940
2.4	GAHU15-250-NG	1800	5700	2250	2140
2.5	GAHU20-390-NG	1800	6050	2350	2650
2.6	GAHU25-390-NG	2100	6230	2650	3120
3	**GAHU with Compressor**				
3.1	GAHU2-50/33	900	5200	1900	1140
3.2	GAHU5-50/33	1200	5500	2050	1380
3.3	GAHU10-100/66	1500	5800	2350	1840
3.4	GAHU15-150/100	1800	6000	2650	2020
3.5	GAHU20-200/133	1800	6300	2650	2490
3.6	GAHU25-200/133	2100	6550	2950	2980

Important Note

Dimensions and weights may vary in tailor-made devices designed.
For ranges outside those listed, consult Timfog.



Timfog mainly serves overseas projects with its approximately 40% of employees who are engineers. By preparing all of its projects in 3D, it prevents mistakes even in the smallest details.

The wide project team keeps working on the project together with our customers and field engineers after the contract signed. Almost perfect production supply assembly process starts at the planning stage. Our engineer supervisors appointed for each project continuously report to our customers during their process on the field. Their periodical availability during the application prevents many misapplications so that construction sites can continue without serious pauses and delays.

The field engineers provide service to our customers with such a process management including the project tracking system which covers the whole project and includes dozens of sub-processes, and ensures that every development can be monitored immediately. In fact, project and site management can be carried out easily and comprehensively with the special project software being used.

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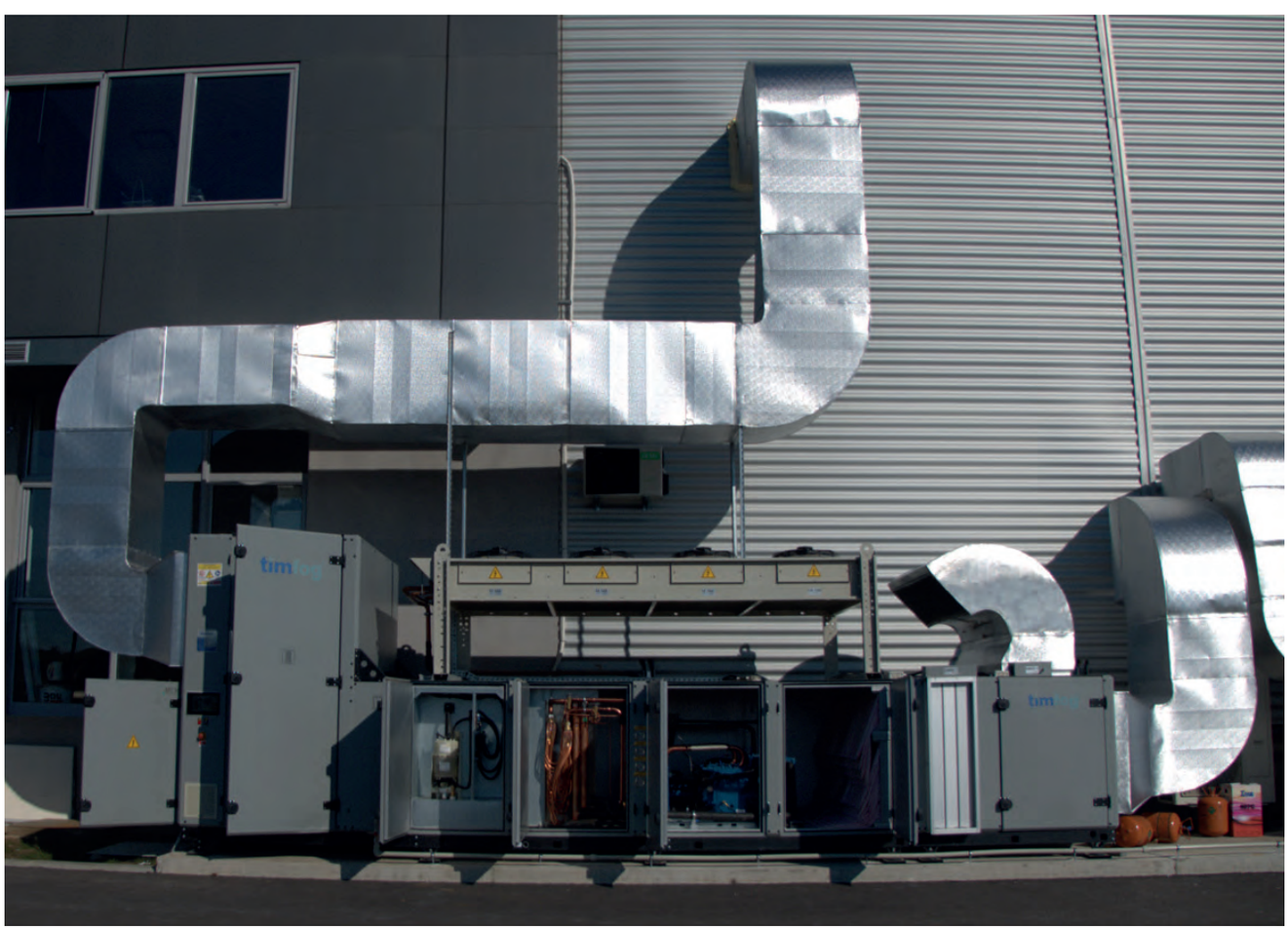
Greenhouse Air Handling Unit
PROJECT MANAGEMENT & SERVICE

Timfog is based on providing a progressive supervision service. Therefore, it acts with accurate service, correct commissioning and continuous periodical maintenance analysis all over the world.

Multilingual, international service engineers, all English speaking, are on site to solve problems. All technical processes are accurately reported to customers and all concerned, both on site and at headquarters. With the help of the records kept, it is possible to get information about the services and other services provided for each system or machine even after many years.



timfog®

timfog.com

Head Office

Şerifali Mah. Türker Cad.
No: 51 P.K. 34775
Ümraniye - İstanbul, Türkiye

T. +90 (216) 466 20 06 (Pbx)
F. +90 (216) 313 43 13 (Fax)

info@timfog.com

Factory

Kamaradere Mah. Dağyolu Cad.
No: 63
Marmaraereğlisi - Tekirdağ / Türkiye

Antalya Office

Çalkaya Mah. Mir Plaza
No: 72/50
Aksu - Antalya / Türkiye

MCM ENGINEERING