100 % Full Fresh Air Energy Recovery Unit

By Indirect / Direct Evaporative Cooling

CG – IDEC - ERV series

Meet and Comply With

- ASHRAE Standard 62.1
- ASHRAE Standard 90.1
- ASHRAE STD 143

- Highest Efficient Cooling Performance
- The Best Of IAQ “Indoor Air Quality”
- Cut Of Electricity up to 90 %
- Environment Friendly.
- Less Co2 Emissions
- Cost Effective Solution
- Superior Performance in Hot and Dry Climates
- Indoor and Outdoor Installation.
- Significant Improving in GWP
- Anti Corrosive Construction.

Buildings / Owner Needs

All Building applications need fresh air to achieve the IAQ - Indoor Air Quality In according to the standard and code requirements.

S S Air Technology “Smart Sustainable Air Technology” present the new generation of Clima Green products of highly efficient 100 % Full Fresh CG - IDEC- ERV “Indirect Direct Evaporative Energy Recovery units”.

Since the fresh air-cooling load represent significant part of the overall air condoning system, it is mandatory to find a way to reduce this capacity by means of high-cost energy recovery system.

The 100% full fresh air of CG – IDEC - ERV technology provide the highest energy recovery performance in comparing with the traditional membrane, heat pipe, run around coil even energy recovery wheel, moreover it provides significant cut of overall cooling tonnage of the air conditioning system depending on the fresh air percentage and the ambient conditions.

The derive cooling force for the CG – IDEC - ERV units is the Return / Exhaust air reclaim as percentage of fresh air, and the relevant temperatures, in most cases the unit could able to secure the desired pre-cooling of fresh air as specified in 2019 - ASHRAE STD-62.1 for the maximum accepted dew point temperatures as 60 °F "15.5 °C".

Why Clima Green CG – IDEC - ERV units??

Clima Geen units fulfill the buildings / Owner needs, it provides affordable and cost-effective air to air energy recovery by Indirect / Direct Evaporative Cooling unit cutting the overall system air cooling capacity and reducing the initial cost, however fulfilling the code and standard regulations such ASHRAE Standard requirements, indoor thermal comfort, energy saving and environmental control.

Benefit’s

Indoor air quality, Thermal Comfort, Energy Savings, Environmental Control and Cost Effective.

- Maximizing the fresh air, IAQ in according to Egyptian code regulation, meet and exceed the ASHRAE STD-62.1.
- Provide indoor Healthy environment improving the human activities.
- Reduce and optimizing the overall air conditioning cooling capacity.
- Electricity cut of energy and less power consumption.
- Lowest initial cost of the units, suit the affordable energy saving approach.
- Less co2 emission and GWP of the overall air conditioning system.
- Less maintenance and operation cost.
- Durable construction and more life span.
- Suitable for the new and existing construction applications.
- No risk of cross air contaminant or infection disease transfer.

CG-IDEC-ERV series Construction Concept

Clima Geen CG-IDEC-ERV units consist of two sections, fully separated as to independent air passage enclosures.

The first section "Primary Air"

Comprise the primary air supply fan, the IEC water cooling coil and evaporative post cooling pads.

The second section "Secondary Air"

Comprise the exhaust fan, the adiabatic evaporative cooling pads well and recirculating pump.

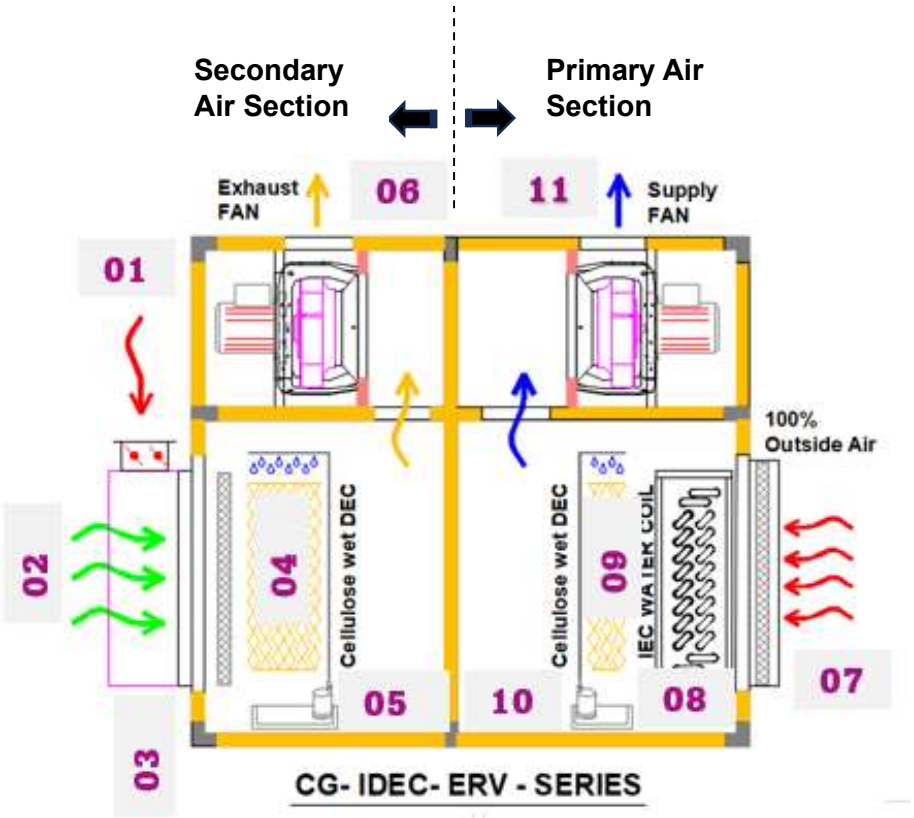
Important, *The Primary air path enclosure is completely separate to the secondary air path, no risk of cross containemenent.*

Secondary Air Section

- **01** Outside Air
- **02** Room Return / Exhau
- **03** Air Mixing
- **04** IEC Wet Pads
- **05** IEC pump
- **06** Secondary Air Fan

Primary Air Section

- **07** Outside Air
- **08** IEC Water coil
- **09** DEC Wet pads
- **10** DEC Wet pads pump
- **11** Supply Air Fan



CG-IDEC-ERV series Working Principles

The unit designed to provide 100% full fresh air as filtered and treated precooling supply air through stand-alone unit, through recovering the room return or exhaust air prior discharged to the outside.

Since the primary air path is completely separate to the secondary air path, so the exhaust air from Toilets, general stores or service utilities spaces could be used as recovery air.

Important, Further exhaust like in kitchen, laundry or laboratory need specific study and treatment prior utilized as an air recovery source.

Primary Air process

The cooling process consists of two stages of cooling.

First stage " Indirect evaporative cooling " : T**he supply air fan blower drawn the 100% intake fresh air filtered through pre- filter and then entering to the IEC water cooling coil , the pre-cooled air that leaving the IEC coil** it is sensible cooling process (no dehumidification occur), it is constant dew point process where no moisture add in the precooled air, IEC water coil deliver the cold water from the evaporative cooling pads located in secondary air section through the recirculating pump.

***Important**, in humid weather, the IEC cooling coil might provide cooling and dehumidification to the outside fresh air, depend on the ambient dew point temperature and cold-water temperature supplying from the evaporative cooling pads.*

The Second stage " Adiabatic evaporative post cooling": That provide post air cooling with adding little moisture content to the air in case.

***Important,** the primary air passing within enclosed air stream path, which is separate to the secondary air path, accordingly there is no risk of air containment's or mixing.*

Secondary Air process

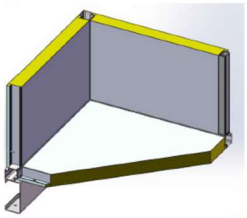
The return / exhaust air extracted from the room spaces and portion of outside air which mixed and drawn by exhaust air fan blower facing the evaporative cooling pads were cooling the return water from the IEC cooling coil in primary air section.

The cooled water re-supplied to the IEC cooling via recirculating submersible pump.

Unit Constructions

Panel Construction

Aluminum Profile - Anodized - Rockwall insulated sandwich panels for primary air-cooling section. While single skin aluminum



Drain Pans

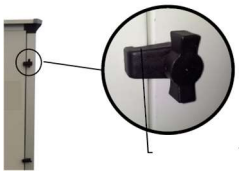
Stainless Steel Drain pan with bottom pan drain hole sloped to side connection.

Base Frame

Epoxy Coated Heavy Duty black steel.

Profile Corners

Re-inforced Plastic / Nylon corners for aluminum profile connections

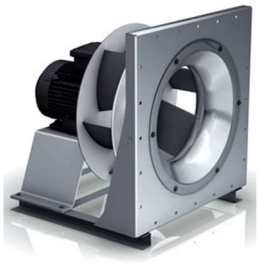


Door Lock

Door Lock in Nylon

Plug Fans

Primary / Secondary Supply air fans, High Efficiency non overloading high pressure backward Curved Centrifugal Plug Fan, Footed mounting, or Wall hanging, direct derive type, statically and dynamically balanced, Aluminum impeller complete with epoxy coated pedestal frame mounting in vibration isolators.



VFD, Variable frequency derive inverter to adjust the air flow against the actual fan static pressure, 0 to 10 v modulating speed control for part load power saving.

IEC Motors

premium efficiency - Aluminum Casing - anti corrosive coating squirl cage induction motor, three phase standard IEC motor, insulation class - F, Efficiency class IE3, Ingress protection IP 54, continuous operation class S1

Air Intake Filter

Aluminum filters for large dust particles with aluminum frame and filter media in multi-layered flat aluminum wire, Washable. Class: G2, mounting: on slide rails or in frames, drawn to sides *though access panel.*
Optional Synthetic filter G4 grade.

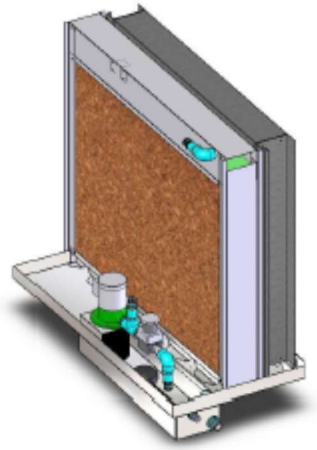
Water Cooling Coil

Copper tubes Aluminum fins air to water heat exchanger coil cooling coil.
The collectors of the coils are equipped with nipples for vent and drain.
The water and direct expansion coils have holes at the lower cover for the drainage of the condensate in the drain pan.
The coils, in standard execution, are subjected to a pneumatic test at a pressure of 30 Bar, by injection of dry air and water immersion.

Coils Enclosures

The coils are housed in specific sections and individually mounted on "L" rails. For easy disassembly, at each coil corresponds a dedicated front panel.
Seals of passage of the collectors EPDM exclusive design *to ensure a perfect air tightness and look perfectly smooth and easily washable inside the panel. The coil can be removed easily, leaving in place the gaskets.*

Direct Evaporative Cooling Pads



Cellulose paper with thickness 200 mm, flute 7 for primary air IEC water coil circuit, while thickness 150mm, flute 5 spacing for primary air post cooling

The wet adiabatic evaporative cooling with recirculated water is equipped with circulating pump and by-pass valve for regulating the flow of water to the wet deck. The tank has a lower sump in which are housed the pump with.

stainless steel mesh filter, the make-up floating valve, the overflow with the drain plug. The lower sump in the water basin allows to reduce the amount of water present in the basin and, resulting almost emptied at each switch over of the pump, ensures the necessary bleed -off (to reduce the concentration of salts in the water and ensure a periodical replacement of the same).

Water Circulating Pump

submersible type - stainless steel water circulating pump European certified, heavy-duty operation for long lifetime and minimum trouble shooting.

Electrical Components

Miniature Circuit Breakers, Motor Circuits Breakers, Contactors, relays, overload, ...

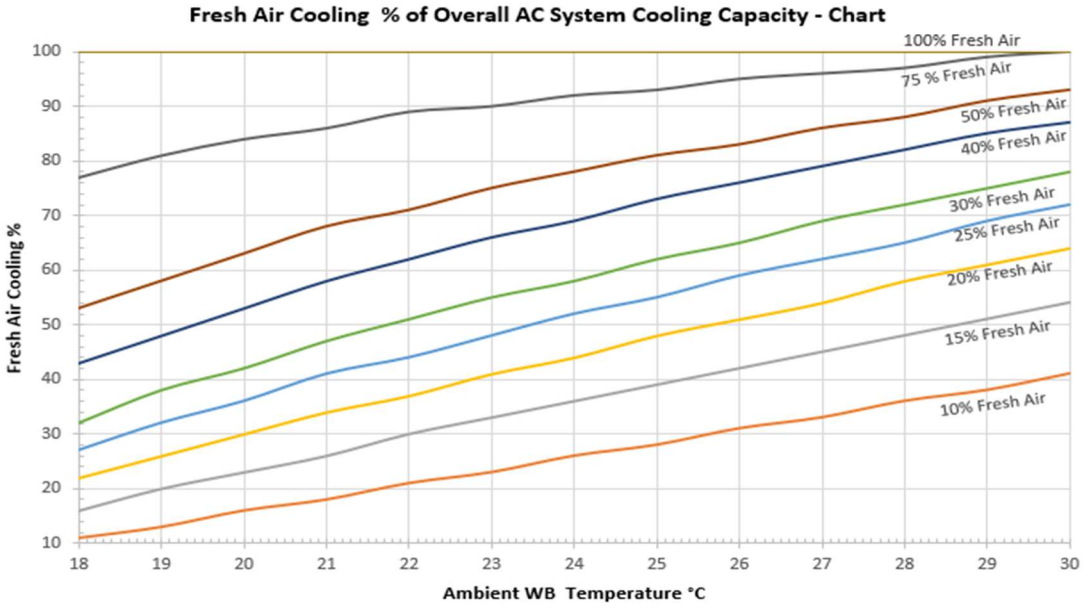
Applications

All Buildings need fresh air as portion of supply air according to code and standard regulations. The fresh air-cooling load represents significant cooling percentage of overall air conditioning system peak demand. this percentage depend on the outdoor wet bulb temperature and the fresh air % of Supply air, Code of practice of administrative commercial buildings need around **10-20 %** fresh air % of supply air while high density occupation buildings as well as medical and clean rooms buildings need around **30-40 %** fresh air percentage of supply air.

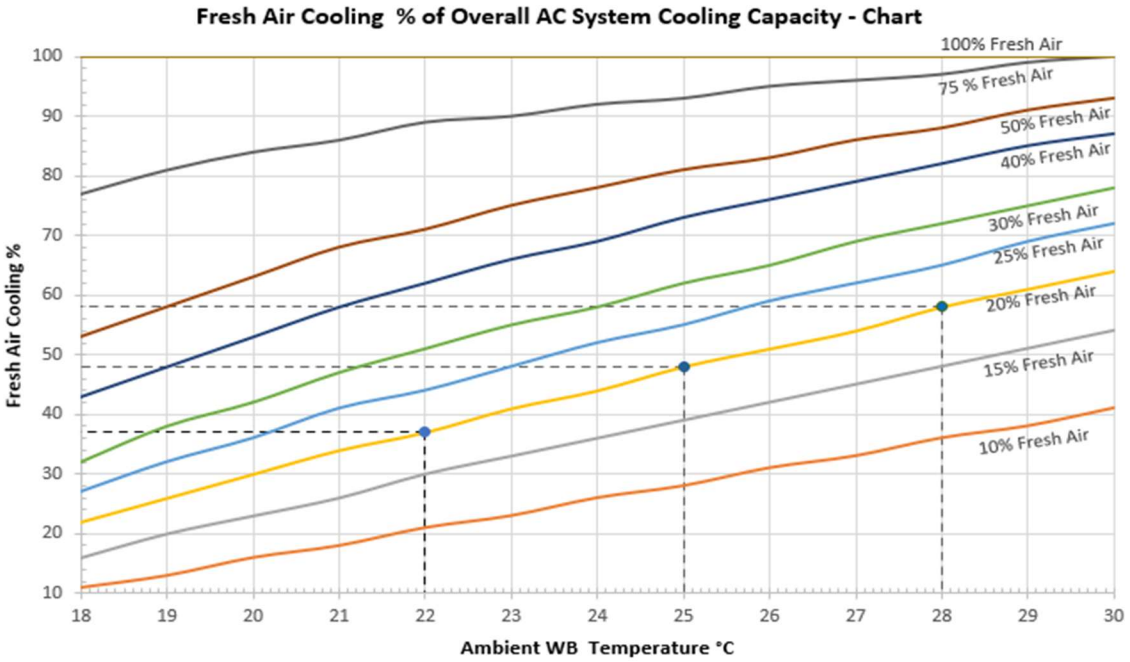
The below table and chart show the fresh air-cooling capacity % of overall Ac system peak cooling at different ambient wet bulb temperature and fresh air % of supply air.

F.A % of Supp. Air	Fresh Air Cooling % of total A/C system cooling Capacity												
	Outside Air - Wb °C												
%	30	29	28	27	26	25	24	23	22	21	20	19	18
10	41	38	36	33	31	28	26	23	21	18	16	13	11
15	54	51	48	45	42	39	36	33	30	26	23	20	16
20	64	61	58	54	51	48	44	41	37	34	30	26	22
25	72	69	65	62	59	55	52	48	44	41	36	32	27
30	78	75	72	69	65	62	58	55	51	47	42	38	32
40	87	85	82	79	76	73	69	66	62	58	53	48	43
50	93	91	88	86	83	81	78	75	71	68	63	58	53
75	100	99	97	96	95	93	92	90	89	86	84	81	77
100	100	100	100	100	100	100	100	100	100	100	100	100	100

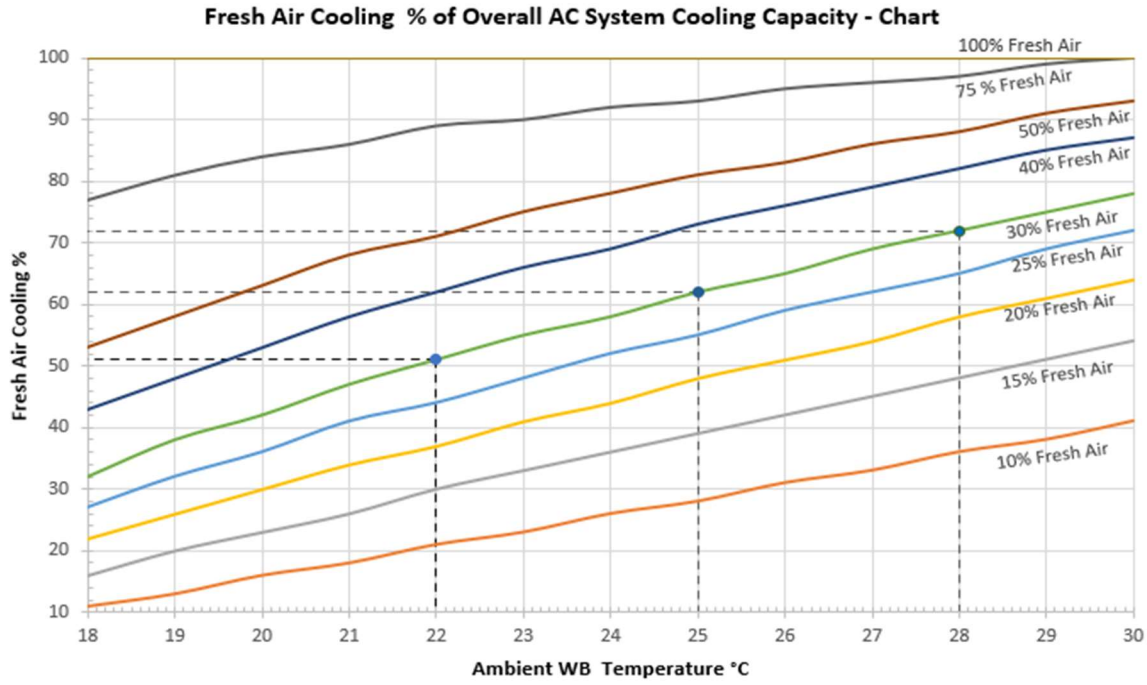
- The tabulated Cooling capacity % values calculated based on room temperature 24 °C and 50 % RH and supply air temperature 14 / 13.5 °C DB/WB
- Regardless the ambient dry bulb temperature, Fresh air-cooling capacity is depending on the ambient outside wet bulb temperature.
- Fresh Air-cooling Capacity as % of the A/C system cooling capacity increase at humid ambient at higher wet bulb temperature.
- Fresh Air-cooling Capacity as % of the A/C system cooling capacity in humid weather like in North coast at 27 °C WB is more than Cairo at 25 °C WB.
- For Example, in Cairo, @ summer 25 °C WB, where 20 % fresh air, the fresh air cooling represents 48 % of the total system cooling capacity required.
** Indirect Evaporative Cooling CG-IDEC-ERV reduce the Overall Ac cooling capacity by 24 % comparing with traditional direct outside air.*
** CG-IDEC-ERV consume less power consumption than traditional A/C system, result in 19 % power savings of overall air-cooled AC / system power.*
** CG-IDEC-ERV price cost rate is around 2.2 USD / CFM less than traditional (Commercial / Industrial) air conditioning units.*



*The Below example chart shows the fresh air-cooling capacity represent **37 to 58 %** of overall Ac system peak cooling at different ambient wet bulb temperature (22, 25 and 28 °C) at fresh air **20% of** supply air.*



Another example chart shows the fresh air-cooling capacity represent 51 to 72 % of overall Ac system peak cooling at different ambient wet bulb temperature (22, 25 and 28 °C) while fresh air 30% of supply air.



A/C system optimization by using CG-IDEC – ERV units

The system optimization based to minimize the full fresh air-cooling capacity and reduce the overall air conditioning peak cooling demand by integrating full fresh air energy recovery equipment CG-IDEC-ERV units.

Case Study

The case study describes how far benefits is by providing **CG-IDEC-ERV** units to the air condoning system

Building Application: Administrative / Commercial

Location: Cairo – Egypt

A/C system: Air cooled water chilled water (ACWCH)

Ambient: 40 / 25 °C Db/WB

Supply air: 81,000 m3/h

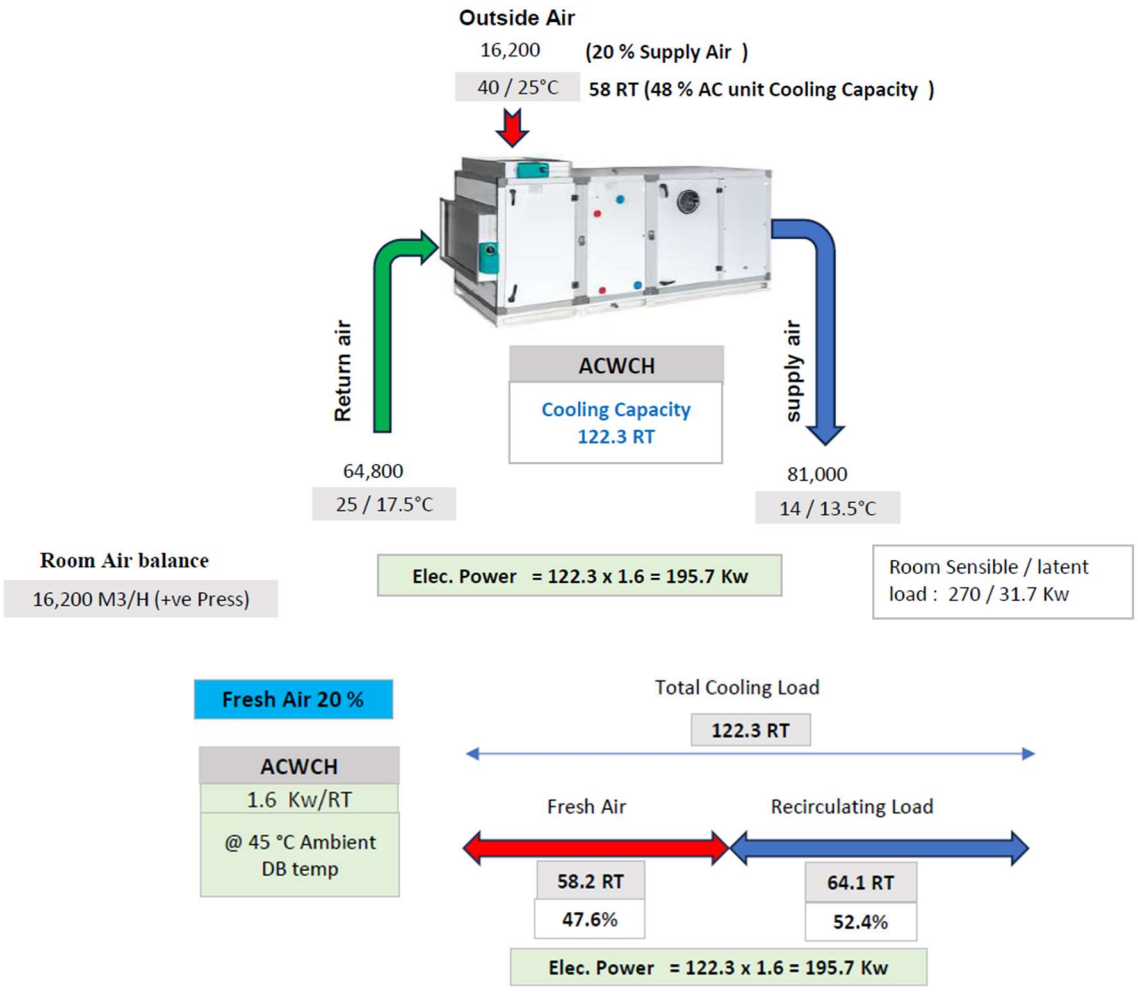
Fresh air: 16,200 m3/h (20 %)

Room Set temp.: 40 C Db / 50 % RH Db/WB

Room Sensible/latent Load.: 270 / 31.7 kw

ACWCH cooling capacity: 122.3 RT

The System Cooling Capacity balance as following chart



The proposal is to provide **CG-IDEC-ERV - 162** unit that provide 16,200 m3/h full fresh air were recovering the return/exhaust air 14,580 m3/h as 90 % of the fresh air (+ve room pressurization) , the selection results as extracted as followings:

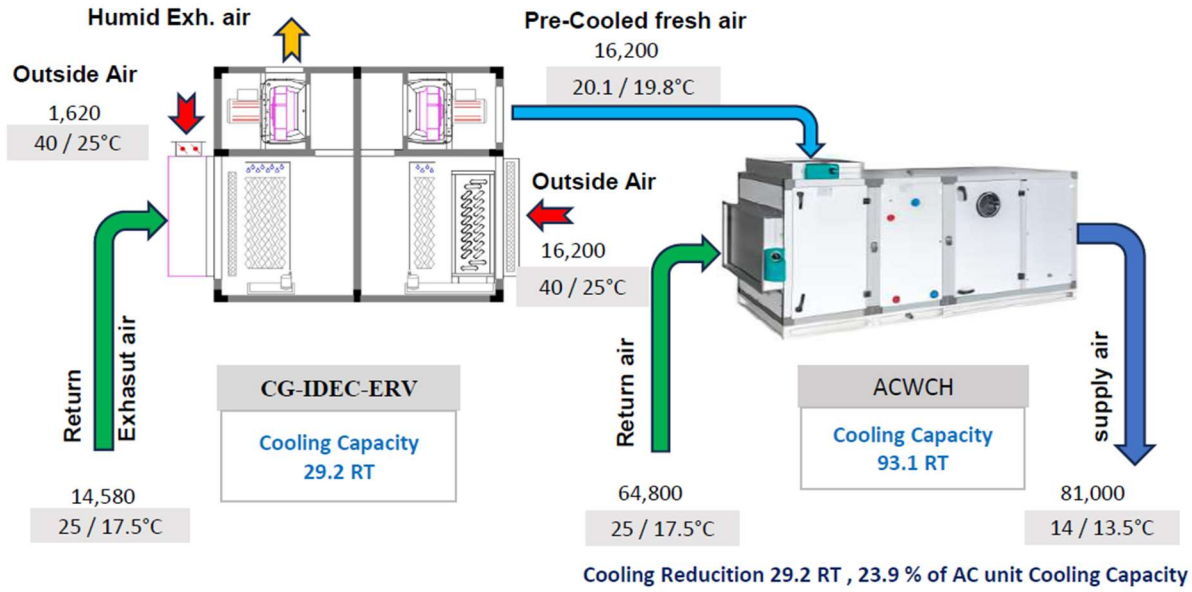
Cooling Capacity	IEC coil	DX - Coil	Wet DEC pads	Over All Cooling
Sensible :	101.7		8.8	111 **31.6** Kw **RT**
Total :	101.7			102 **29.1** Kw **RT**

Power Consumption			MED ESP
Supply Fan	2	2.2	1.2"
Exhaust Fan	2	2.2	1.5"
Compressors			
IEC pump	2	0.75	
DEC pump	1	0.37	
		10.67 **Kw**	

Performance		
COP	10	
BTUH/W	36	
Kw/RT	0.34	
Sensible Effictiv.	127	%
Total Effictiv.	74	%
Enthalpy Recovery Ratio	67	%

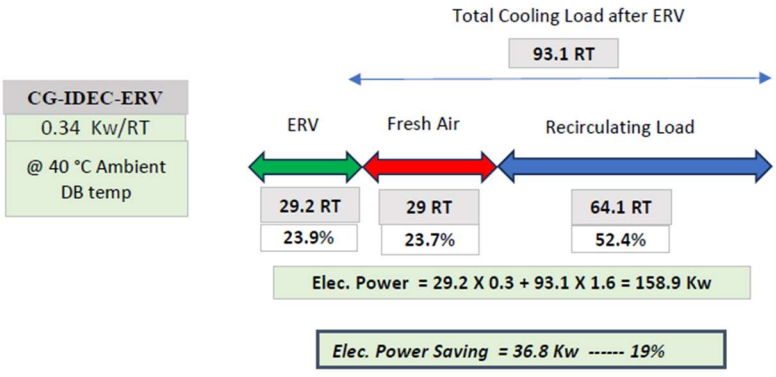
Water Consumption		
IEC Wat. Evapor.	184	*L/H*
DEC Wat. Evapor.	12	*L/H*
Make Up Water	216	*L/H*
DX coil Condensation		*L/H*
IEC coil Condensatior		*L/H*

The System Cooling Capacity balance after providing CG-IDEC- ERV as following chart



Cooling Reducition 29.2 RT , 23.9 % of AC unit Cooling Capacity

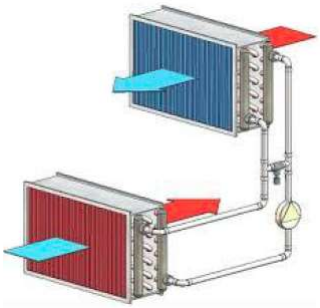
Elec. Power = 29.2 X 0.3 + 93.1 X 1.6 = 158.9 Kw



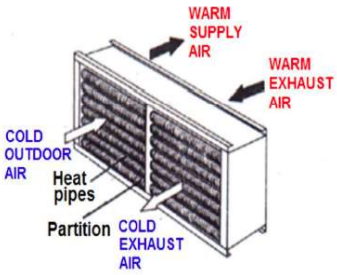
Elec. Power = 29.2 X 0.3 + 93.1 X 1.6 = 158.9 Kw

Elec. Power Saving = 36.8 Kw ------ 19%

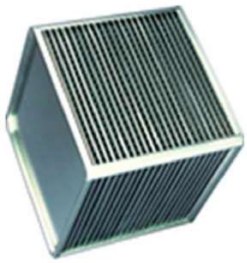
Comparison between conventional Air to Air Recovery devices and CG-IDEC – ERV



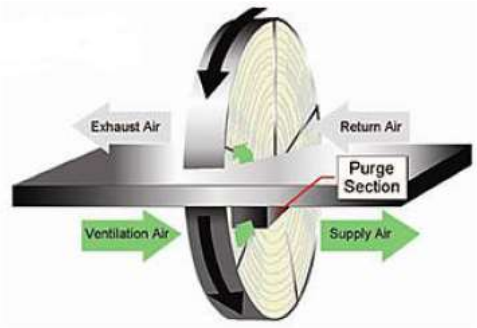
Runaround Coil (Sensible)



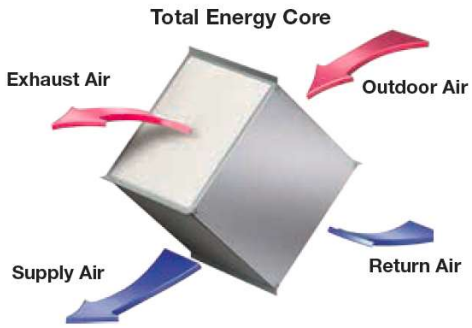
Heat Pipe (Sensible)



Fixed Plate Heat Core (Sensible)

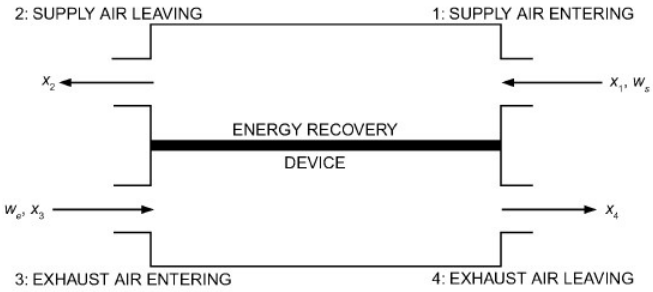


Energy Wheel (Energy)



Membrane Energy Core (Energy)

Base Formulas : ASHRAE – System And Equipment's – Chapter-26 "Air To Air Energy Recovery Devices"



$$\varepsilon_{sensible} = \frac{\dot{m}_2(c_{p,1}T_1 - c_{p,2}T_2)}{\dot{m}_{min}(c_{p,1}T_1 - c_{p,3}T_3)}$$

$$\varepsilon_{total} = \frac{\dot{m}_2(h_1 - h_2)}{\dot{m}_{min}(h_1 - h_3)}$$

$$\varepsilon = \frac{\text{Actual transfer of moisture and/or energy}}{\text{Maximum possible transfer between airstreams}}$$

$$\text{Enthalpy recovery ratio} = \frac{h_1 - h_2}{h_1 - h_3}$$

where

$\dot{m}_n$ = mass flow rate at station n, kg/s
$\dot{m}_{min}$ = minimum of $\dot{m}_2$ and $\dot{m}_3$, kg/s
$c_{p,n}$ = specific heat of dry air at station n, kJ/(kg·K)
h_{fg} = heat of vaporization of water, kJ/(kg·K)
T_n = dry-bulb temperature at station n, °C
W_n = humidity at station n, kg_w/kg_{da}
h_n = enthalpy at station n, kJ/kg

ERR Should not less than 50 % in according to AHRAE STD 90.1

Air To Air Energy Recovery Technology Comparisons

	Total Energy Wheel	Membrane Plate	Fixed Plate	Heat Pipe	Run around Coil	CG-IDEC-ERV
Energy Transfer	Sensible & Latent	Sensible & Latent	Sensible	Sensible	Sensible	Sensible & Latent
Sensible Effectiveness	65 to 80 %	55 to 75%	50 to 75%	40 to 60%	45 to 65%	85 to 110 %
Total Effectiveness	55 to 80 %	35 to 70%	20 to 50%	15 to 35%	-	45 to 185 %
Media	Polymer or Aluminum	Polymer or Fiber	Aluminum	Refrigerant pipes	Water Coil Co-Tubes Alum-Fins	Evaporative Cooling - Water Coil Co-Tubes Alum-Fins
Desiccant	Molecular Sieve or Silica Gel	-	-	-	-	-
Applications	Commercial	Commercial	Commercial and light industrial	Commercial	Commercial and light industrial	Commercial and light industrial
Benefits						
Effictiveness	Relatively Higher total effectiveness	High sensible and Total Effictivness	Less sensible Effictivness	Less sensible Effictivness	Less sensible Effictivness	Highest Sensible effectiveness
Moving Parts and maintenance	Minor moving parts	No moving parts	No moving parts	No moving parts	More moving parts and control	Lower moving parts
Primary and Secondary recovered air path	low cross-leakage	Extremely low cross-leakage	Extremely low cross-leakage	Two independent primary and secondary air path - no cross air containments		
EATR %	0.5 to 10	0 to 5	0 to 2	0		
Applicatioans	Commercial	Commercial	Commercial	Commercial and Industrial		
Limitations	Recommended for restroom exhaust with but with air purge	Recommended for restroom exhaust with accepted EATR %	Recommended for restroom exhaust with accepted EATR %	Recommended for restroom exhaust		
Maintenance	periodical segmants cleaning only	No moving parts, less maintenance	No moving parts, less maintenance	No moving parts, less maintenance	Moving parts need periodical maintenance	
Initial Cost	Relatively higher initial cost	High initial cost	Fair Initial Cost	High initial cost	Highest initial cost	Fair Initial Cost

*- **Effictivness** based on Chapter-26 "Air to Air energy Recovery" -ASHRAE - system and Equipments*
*- **EATR** : Ehaust Air Transfer Ratio*

Physical Data

Model Serial Number	CG-IDEC- ERV-54	CG-IDEC-ERV -81	CG-IDEC-ERV -108	CG-IDEC- ERV -162	CG-IDEC-ERV -216
Nominal air Flow (m3/h)	5,400	8,100	10,800	16,200	21,600
(CFM)	**3,000**	**4,500**	**6,000**	**9,000**	**12,000**
Input Power Kw (STD/HI) *	2.8 / 3.6	3.8 / 5.2	7.25 / 9.25	10.7 / 13.9	14.6 / 18.6
Sensible Effectiveness % **	85 to 110				
Total Effectiveness % **	45 to 185				
IEC water Cooling Coil					
Type	CU/ALU fins				
No of rows	8				
Face Velocity (m/s)	2.5 to 2.75				
Frame Coating	Epoxy				
Air Pressure Drop (pa)	160				
IEC / DEC -Recirculating pump					
Type	Submersible				
Material	Plastic Casing / Stainless Steel core				
Quantity (IEC/DEC)	1 / 1	1 / 1	1 / 1	2 / 1	2 / 1
Capacity (Kw)	0.55 / 0.1	0.75 / 0.1	1.1 / 0.15	0.75 / 0.37	1.1 / 0.37
Voltage	230/1/50		380/3/50		
IEC - Evaporative Cooling - Pads					
Type	Flute - 7				
Material	Cellulose paper				
Area (m2)	2.5 to 2.75				
Face Velocity (m/s)	0.55	0.75	1.1	1.5	2.2
Thickness (mm)	200				
Air Pressure Drop (pa)	120				
Efficiency (%)	80				
DEC - Evaporative Cooling - Pads					
Type	Flute - 5				
Material	Cellulose paper				
Face Velocity (m/s)	2.5 to 2.75				
Area (m2)	0.55	0.75	1.1	1.5	2.2
Thickness (mm)	150				
Air Pressure Drop (pa)	90				
Efficiency (%)	85				
Primary - Supply Air Fan					
Type	Plug Fan				
Nominal Air Flow (m3/h)	5,400	8,100	10,800	8,100	10,800
Quantity	1	1	1	2	2

Physical Data continued

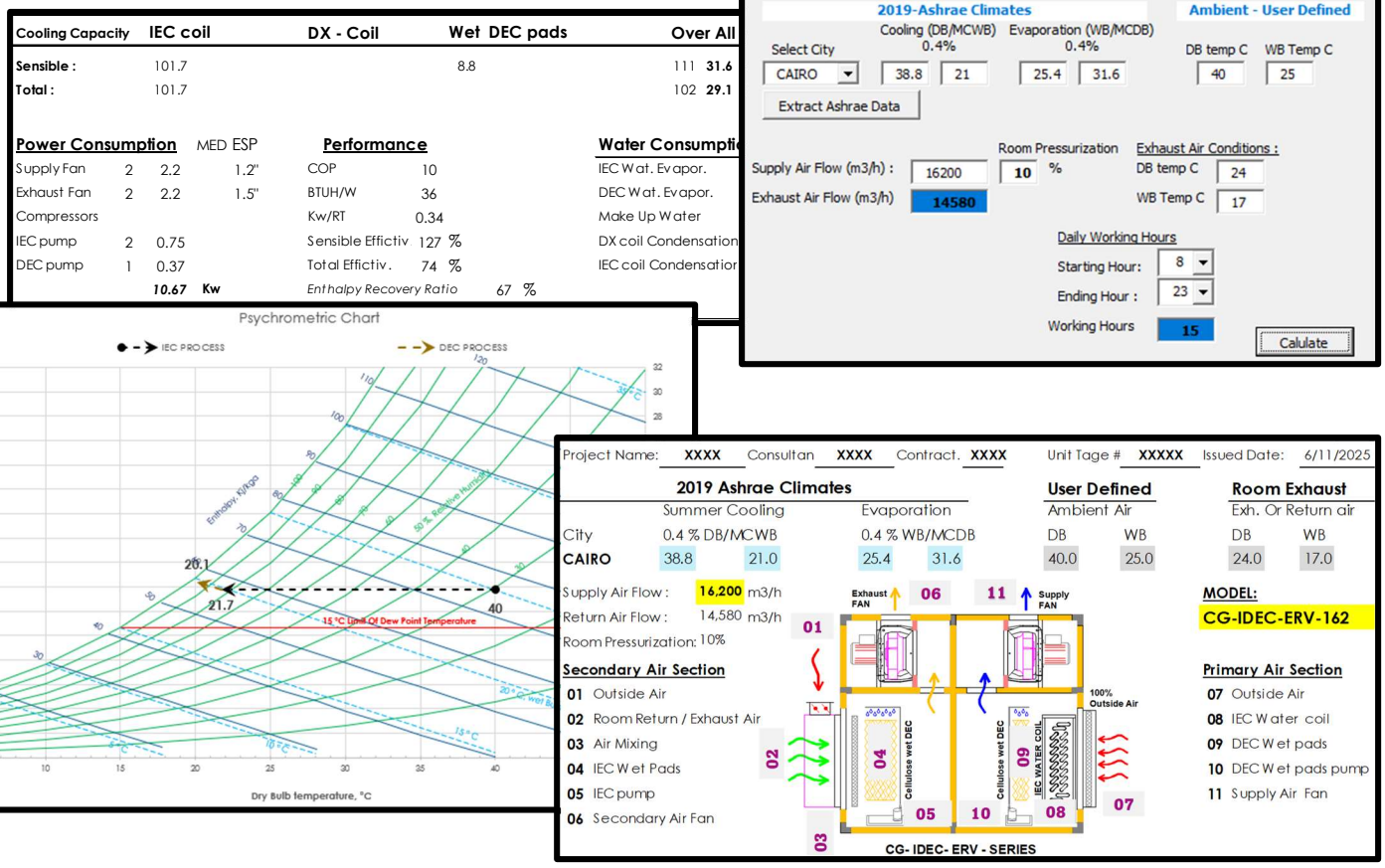
Size (mm)	450	500	560	500	560
Material	Aluminum				
Frame Coating	Epoxy				
Derive	Direct				
Speed	VFD (optional)				
Motor	IEC				
Power (STD/Hi) Kw- Each	1.1 / 1.5	1.5 / 2.2	3.0 / 4.0	2.2 / 3.0	3.0 / 4.0
Efficiency Class	IE3				
Insulation Class	F				
Ingress Protection	IP54				
Secondary - Exhaust Air Fan					
Type	Plug Fan	Plug Fan	Plug Fan	Plug Fan	Plug Fan
Nominal Air Flow (m3/h)	5,400	8,100	10,800	8,100	10,800
Quantity	1	1	1	2	2
Size (mm)	450	500	560	500	560
Material	Aluminum				
Frame Coating	Epoxy				
Derive	Direct				
Speed	VFD (optional)				
Motor	IEC				
Power (STD/Hi) Kw- Each	1.1 / 1.5	1.5 / 2.2	3.0 / 4.0	2.2 / 3.0	3.0 / 4.0
Efficiency Class	IE3				
Insulation Class	F				
Ingress Protection	IP54				
Filters					
Type	Pre-filter	Pre-filter	Pre-filter	Pre-filter	Pre-filter
Material	Aluminum-Washable Flat type				
Face Velocity (m/s)	2.5 to 3.0				
Thickness (mm)	25	25	50	50	50
Air Pressure Drop (pa)	50	50	65	65	65
EU - Efficiency Grade	G4				
Electrical / Control					
Electrical Panel	Panel Components by Schnieder				
Operation Modes	1- Pre - Cooling, 2- Ventilation Mode				
Control Module	DDC - Controller - Optional				

*- STD/HI *: Standard and Hi static duct applications.*

*- Effectiveness **: Based on IEC process only @ 24 °C DB / 17 °C Wet Bulb Temperature room return/exhaust temperatures*
- Unit could stable in duty working as much as outdoor temperature reaches 50 ° C.

Selection Software:

Clima-pro ver.01 software, provide flexibility for the unit selection either standard or energy recovery, the weather data extracted from 2019-ASHRAE-Climate, the user could write different outdoor design conditions through user defined option, as well as supply air flow and the return air condition, and required room pressurization, the software provide all the air properties as well as process plotting in Psychrometric chart and cooling performance for each cooling stage. annual analysis also available in according to 2015-ASHRAE - IWEC "International Weather for Energy Calculations.



Electrical wiring and Control

Sample wiring diagram for model # CG-IDEC- ERV -162

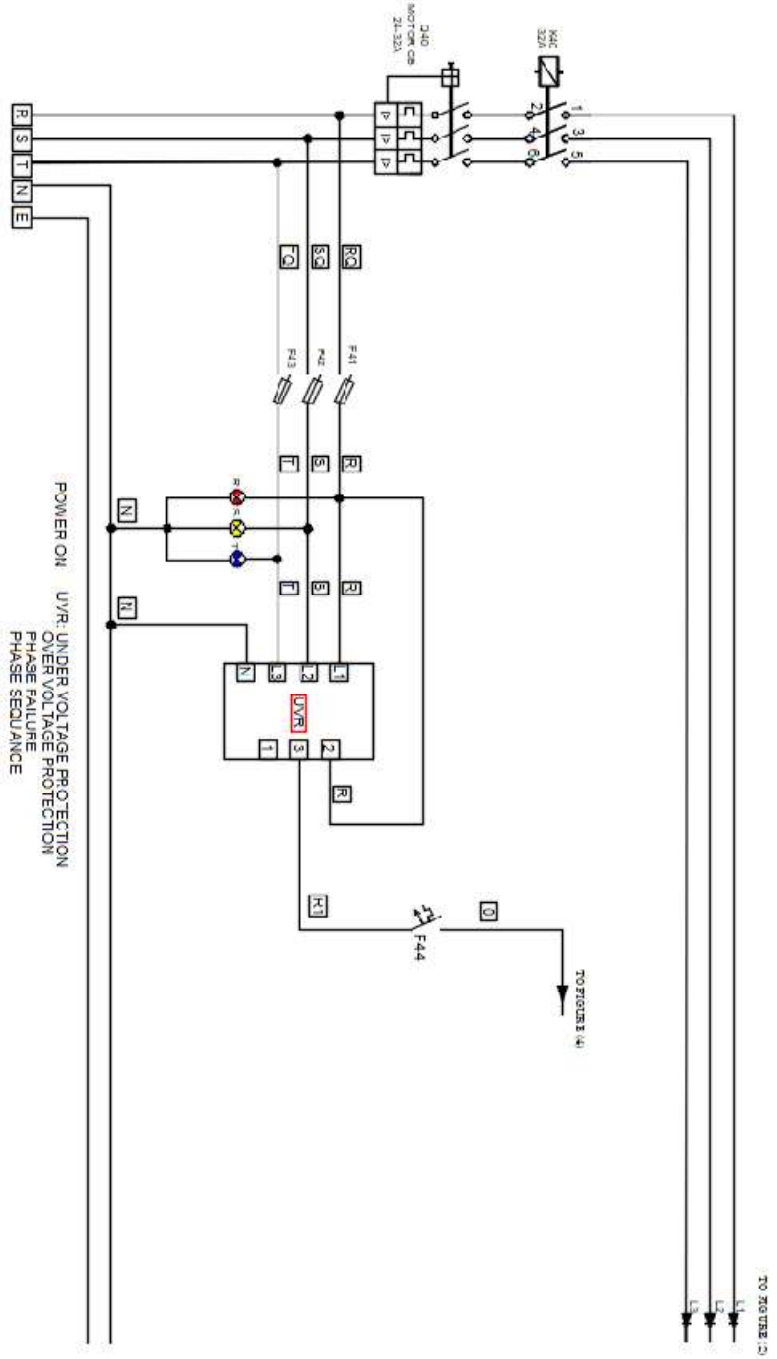


Figure 01

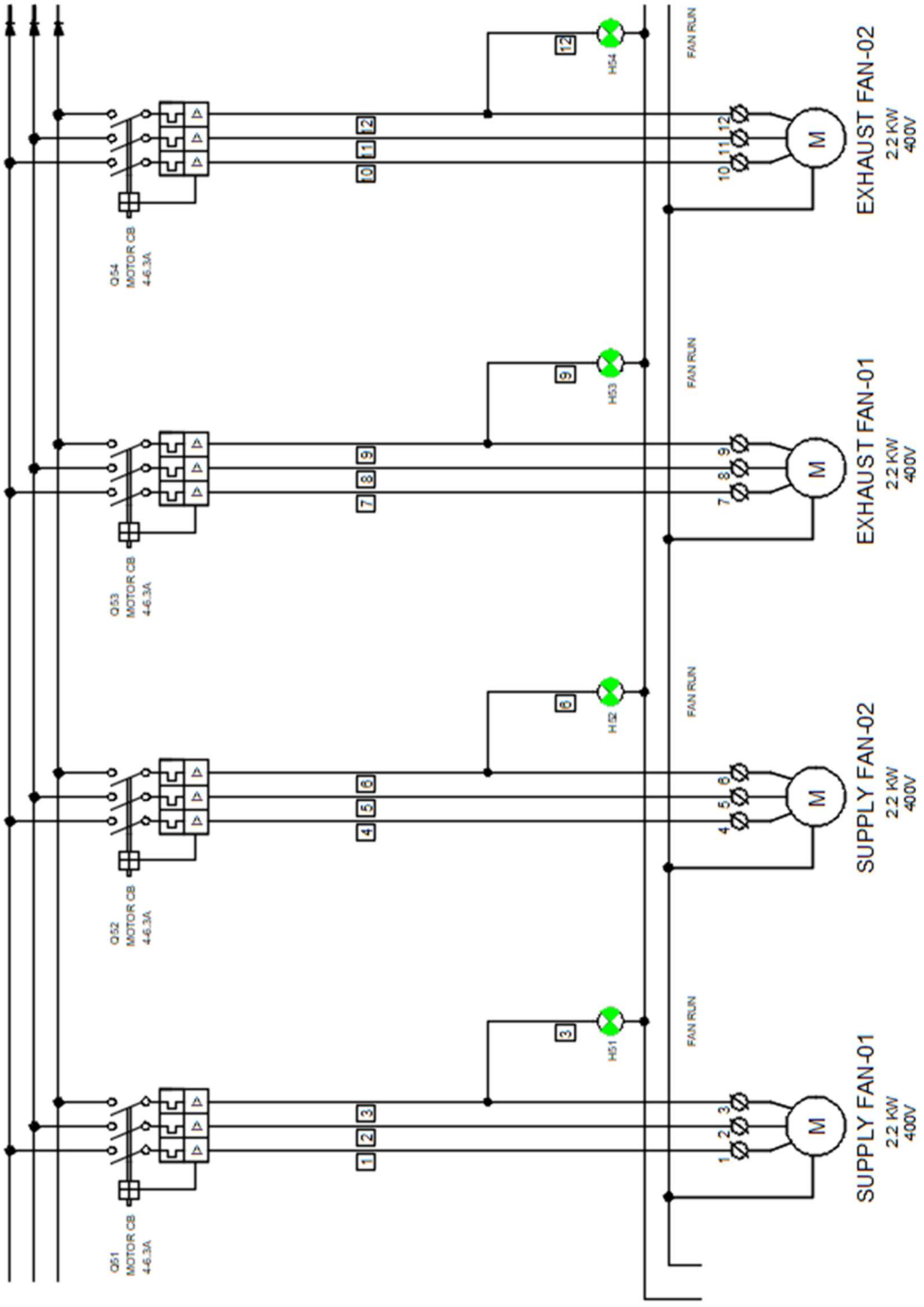

EXHAUST FAN-02
2.2 KW
400V
EXHAUST FAN-01
2.2 KW
400V
SUPPLY FAN-02
2.2 KW
400V
SUPPLY FAN-01
2.2 KW
400V
FAN RUN
MOTOR CB
4-6.3A
Q54
Q53
Q52
Q51
H54
H53
H52
H51
M

Figure 02

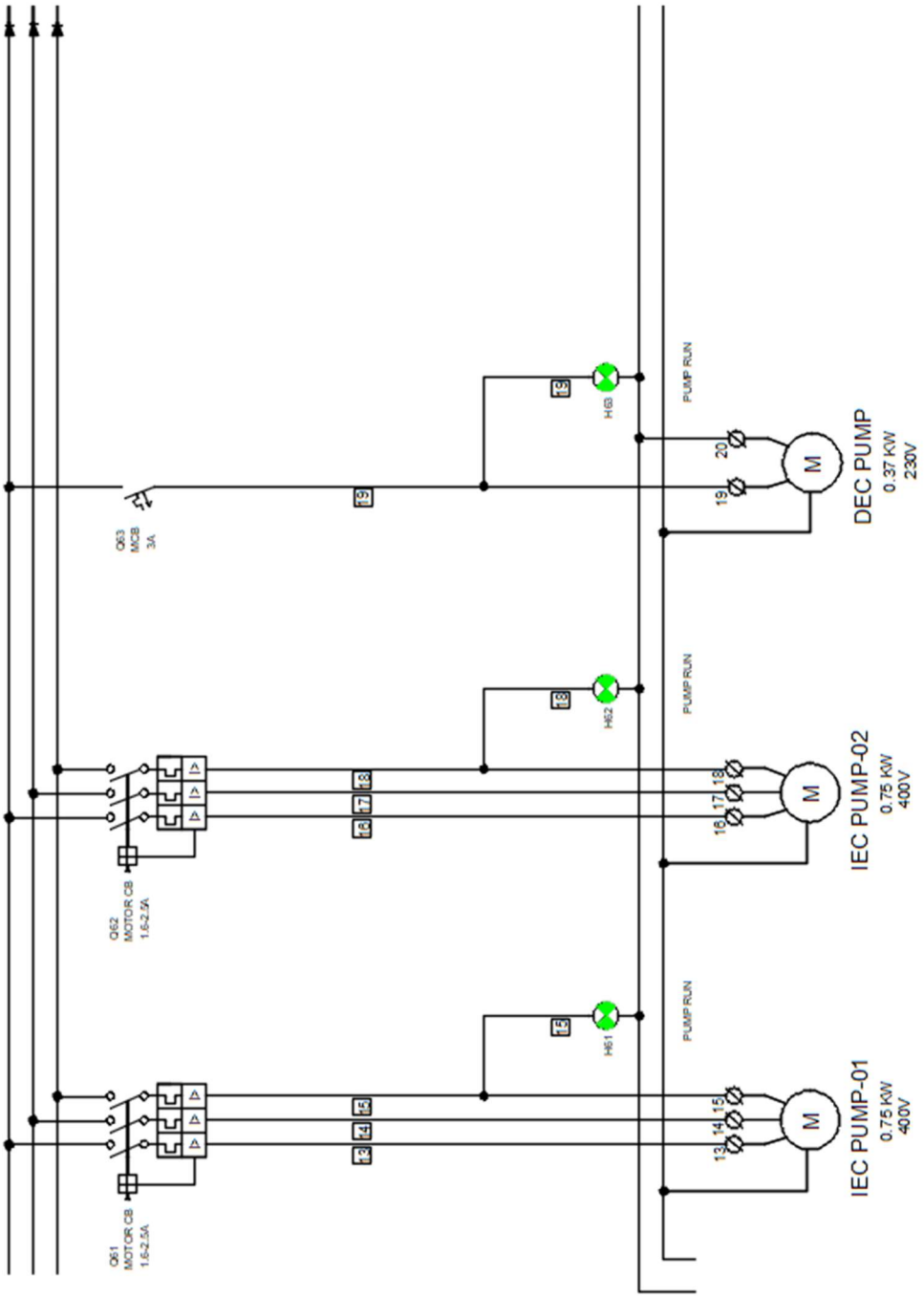

PUMP RUN
DEC PUMP
0.37 KW
230V
IEC PUMP-02
0.75 KW
400V
IEC PUMP-01
0.75 KW
400V
MOTOR CB
MCB
3A

Figure 03

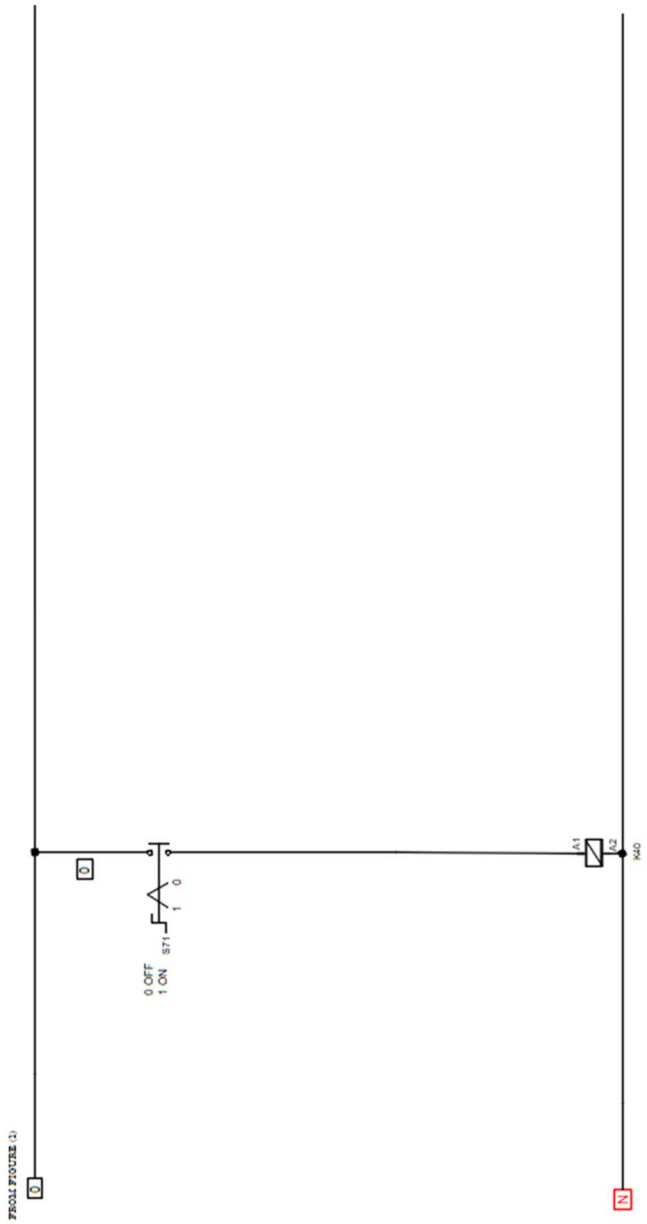
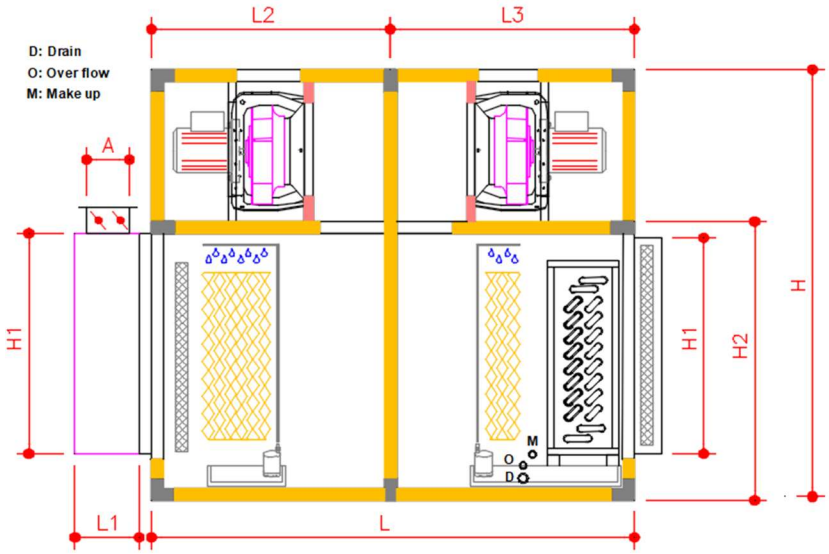
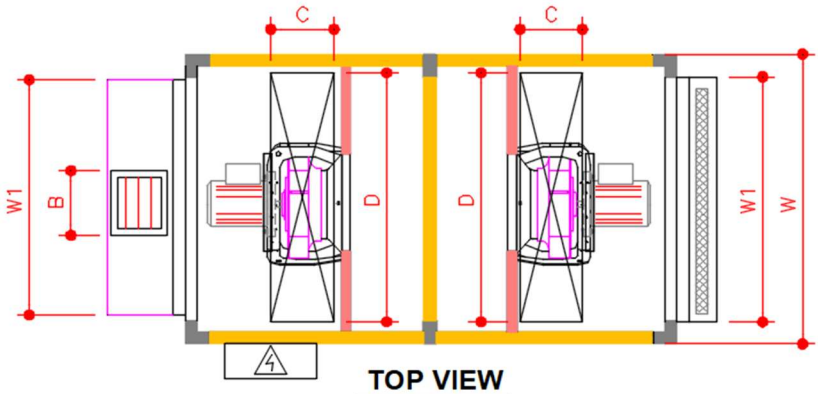


Figure 04

Dimensional Data



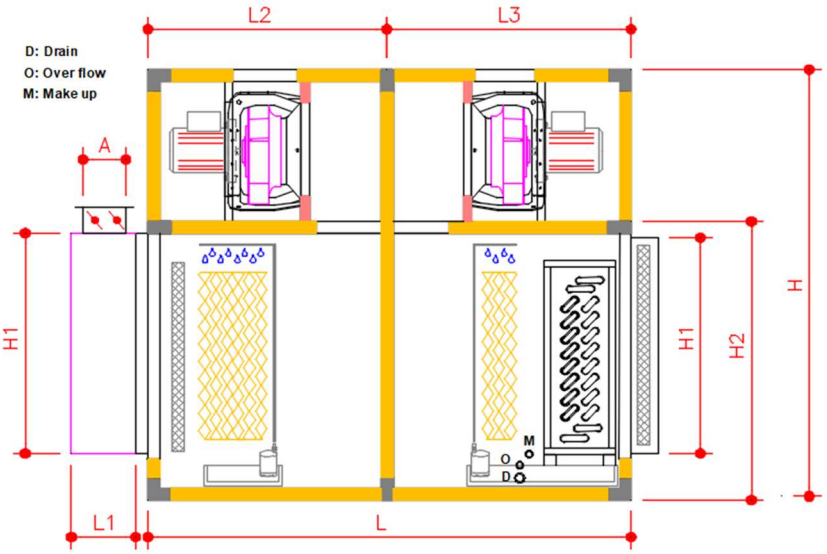
ELEVATION VIEW



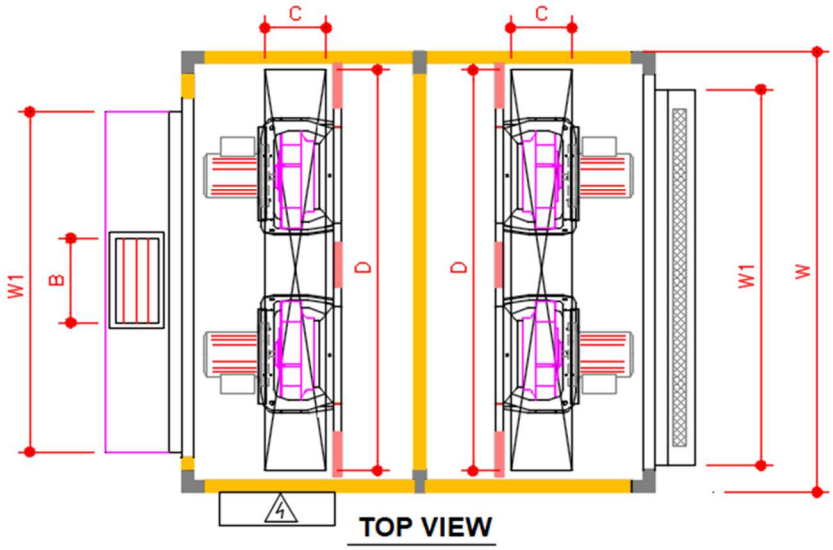
TOP VIEW

CG- IDEC- ERV- 54 TO 108

Size	L	W	H	L1	L2	L3	W1	H2	a	b	c	d	D	M	O
CG-IDEC-ERV-27	1700	900	1900	300	800	900	700	1150	200	200	800	800	40	20	40
CG-IDEC-ERV-54	1800	900	2100	350	850	950	700	1350	250	200	800	800	40	25	40
CG-IDEC-ERV-81	1800	1200	2100	350	850	950	1000	1350	250	250	1100	1100	40	25	40
CG-IDEC-ERV-108	2000	1700	2100	400	950	1050	1500	1350	300	300	1600	1600	50	25	50



ELEVATION VIEW



TOP VIEW

CG - IDEC- ERV-162 TO 216

Size	L	W	H	L1	L2	L3	W1	H2	a	b	c	d	D	M	O
CG-IDEC-ERV-162	2200	2000	2250	400	1050	1150	1800	1400	300	350	1900	1900	50	32	50
CG-IDEC-ERV-215	2200	2200	2250	400	1050	1150	2000	1400	300	400	2100	2100	50	32	50

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