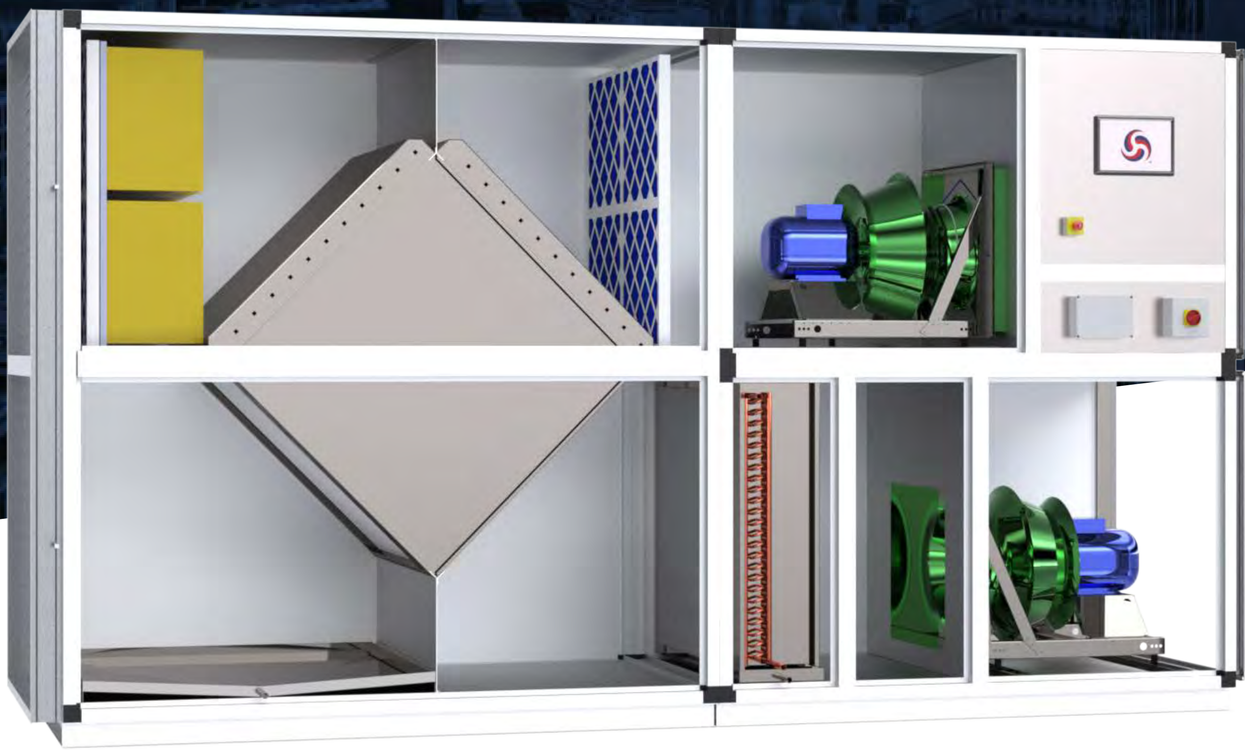
air handling & conditioning

PXA3MX

Plate Exchanger Aluminium 3-Way Mix Swimming Pool Application



Selection Data

40 1979 2019

Company Profile

ECE UK Ltd is a privately owned company that was established in 1979 by the existing directors and shareholders. We operate from our 4,000m² manufacturing facility in Rochester where we produce air handling / conditioning units and controls of the highest quality; which is reflected by our level of customer retention.

With forty years of experience, we are a leader in the field of air handling, conditioning and control systems.

Our experienced and knowledgeable members of staff have obtained qualifications from HNC to Master's Degree. To compliment this we provide an in-house and external training programme. We are committed to working in partnership with Consultants, Contractors and End-Users, providing added value through technical innovation, service excellence and the ability to provide energy efficient solutions.

ECE UK offers a wide range of Products and Services that complement our PXA range of Air Handling Units including

Air Conditioning

Heat pump units and interconnecting refrigeration pipe work.

Controls

Trend Control systems either mounted internal to AHU or remote.

Site Wiring

Our qualified engineers would install all interconnecting control wiring external to the air handling unit along agreed routes.

Plant Movement

Refurbishment, Removal, and Installation of Air Handling Units, Air Conditioning Units and Controls.

After Sales

Warranty assistance and troubleshooting of site issues for Air Handling Units, Air Conditioning Units and Control Systems.

Service & Maintenance

Platinum, Gold and Silver maintenance packages for Air Handling Units, Air Conditioning Units and Control Systems.

By providing the many Products and Services in one place we can offer you the convenience of obtaining all your ventilation, air conditioning and control requirements from one manufacturer.

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How things have changed

Since the early 1970s swimming as a leisure activity has seen a small revolution. Traditionally customers swam in simple, rectangular pools. The water could be relatively cold, as people did not spend long in it.

As the industry built pools of different shapes and styles, with features that added to the fun, customers were expected – and came to expect - to stay longer in the pool hall, and to be warmer. So temperatures crept up, attracted customers, and became a selling point.

Now swimming is second only to walking as the nation's most popular physical activity with over 22% of adults and 50% of young people taking part on a regular basis. It is ideally suited for people with disabilities and the elderly or infirm who might have difficulties with other forms of exercise.

Swimming, like all other sports, can play a significant part in community regeneration and new or refurbished pools can provide much valued facilities that make an important contribution to community cohesion and general health and well-being.

Choice of Ventilation

Clearly the overriding imperatives are user comfort and air quality when selecting the correct Air Handling Unit (AHU).

ECE UK Air Handling Units are used to dehumidify and heat the pool hall. Our AHUs use the extracted warm and humid air to heat the incoming fresh air. Usually the greater the efficiency of the heat exchange process the greater the air resistance through it and the more fan power is used. ECE UK AHUs select heat exchangers with the highest efficiency and lowest resistance to give industry leading specific fan powers.

Pool Water Temperature

Over the years there has been a steady trend to increase water temperatures to increase customer satisfaction. This is demonstrated in the latest update of the PWTAG publication that quotes temperatures range for swimming pools from 1999 to 2016. It should be noted that the PWTAG 2009 document also advises that operators may run their pool satisfactorily at temperatures 1-2 degrees lower than the recommended maximum.

Pool types / uses	Previous / current recommended maximum pool water temperature		
	PWTAG 1999	PWTAG2009	PWTAG2016
Competitive swimming and diving, fitness training	27°C	28°C	26-28°C
Recreational, adult teaching, conventional main pool	28°C	29°C	27-29°C
Leisure pools	29°C	30°C	28-30°C
Children's swimming	As above	31°C	29-31°C
Babies, young children, disabled	30°C	32°C	30-32°C
Hydrotherapy	-	35°C	32-36°C
Spa pools	-	40°C	32-36°C

Pool Hall

The temperature of the pool hall air should normally be maintained at the water temperature, thus the temperature, relative humidity and velocity of the air, and water temperature need to be linked and balanced so as to optimise user comfort and minimise evaporation from the pool water as follows::

- Air temperature approximately 30°C (assuming 29°C water temperature)
- Air velocity approximately 0.1m/s in the occupied areas of the pool hall
- Minimum fresh air supply 6 – 10 air changes / hour
- Air temperatures over 30°C should be avoided.
- Hydrotherapy and aquatic rehabilitation pool air temperature should be maintained at approximately 25 to 28°C
- Relative humidity should be maintained at a level of 60% (no less than 50%, no more than 70%) throughout the pool hall area. Levels above 70% produce a risk of discomfort and condensation, and levels lower than 50% can increase evaporation and energy use.
- The pool hall area (water plus wet surrounds) should preferably be ventilated at a rate of over 10 litres of ventilation air per second per square metre of pool hall area.
- Where leisure pools include extensive water features, consideration should be given to an increase in the ventilation rate.
- Ventilation systems should be designed to provide a minimum of 12 litres per second of fresh air for each occupant of the pool hall (bathers, staff and spectators). An extra 10% on top of the running rate should be available when necessary (e.g. for temporary higher bather loads or if high levels of contaminants are detected in the pool atmosphere)
- Where the ventilation system is capable of using recirculated air, at least 30% of the air content should be provided from a fresh source where possible.

There should be even distribution and extraction of warm air from the pool hall so there are no draughts on the pool surrounds or in the shallow end where people may be standing up.

Energy Consumption

Swimming pool water needs to be continually heated in order to overcome the cooling effect of evaporation and maintain comfortable temperatures.

In order to achieve the greatest savings potential, pool hall managers should know where the majority of their energy is being consumed.

Typical common areas for attention within a swimming pool are:

- Space heating and ventilation
- Water heating and treatment

In each of the key consumption areas, there are opportunities to save energy:

Air Handling Unit – the investment pays off in several ways including lower energy consumption, lower investment for heat generation and distribution and less damage to the pool environment.

Control – all energy-consuming equipment should be controlled carefully to give the required conditions and turned down or switched off when not required.

Pool covers – the use of pool covers out of hours reduces the evaporation rate from the pool surface and can save significant amounts of energy in swimming pools. The lower evaporation rate reduces the energy needed to keep the pool water heated to the required temperature and the resulting reduction in energy use is significant.

Maintenance – a number of energy efficiency measures can be carried out as part of routine maintenance for little or no extra cost.

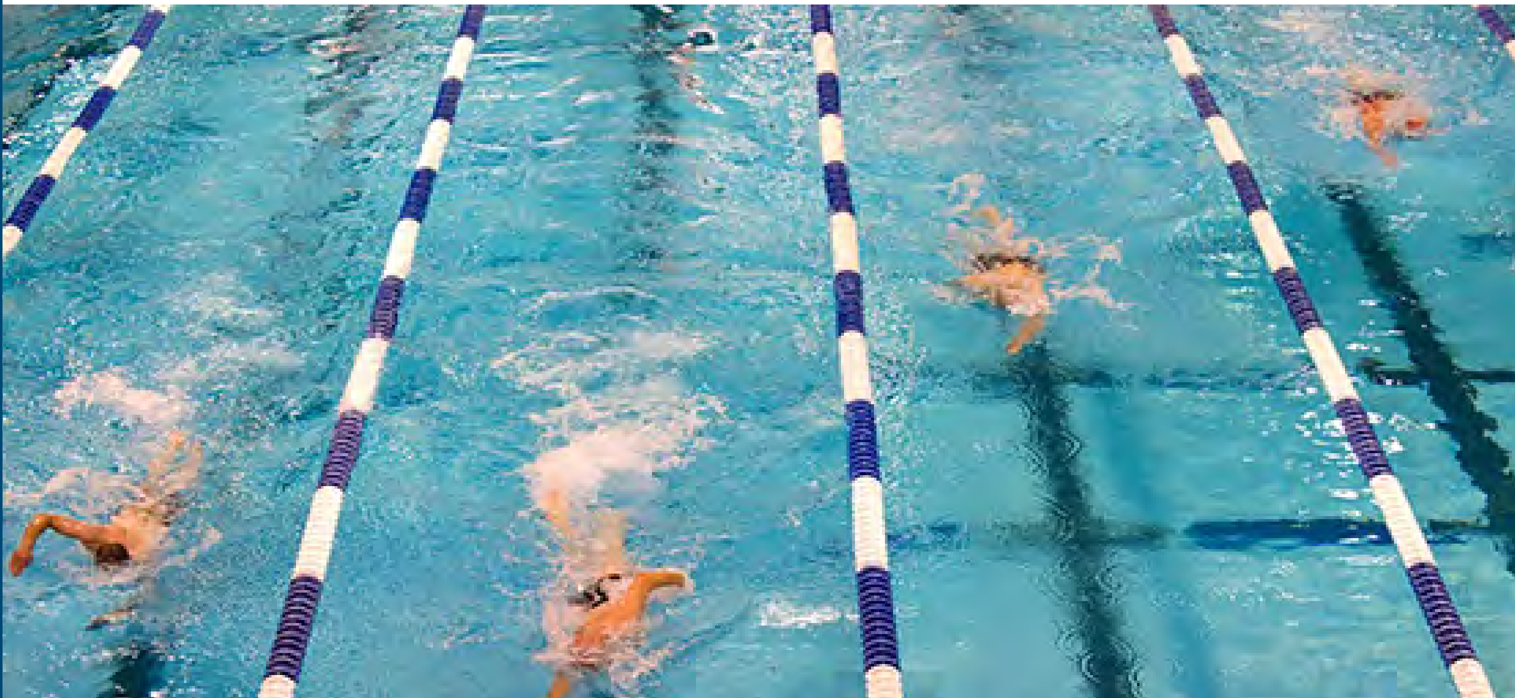
Moreover, most electricity wastage is within the control of end users and can be minimised through good energy management and increased awareness.

Pool Halls - Space Heating & Ventilation

Space heating and ventilation accounts for a large proportion of energy use in pool halls – which means that there are big opportunities to make savings. However, it is important to ensure that the primary functions of the heating, ventilation and air conditioning system are not compromised.

The ventilation system is normally the primary (or only) means of:

- Controlling the pool hall air quality, temperature and humidity so as to reduce evaporation from the pool and prevent condensation (and, potentially, corrosion damage).
- Maintaining comfortable environmental conditions for different occupants.
- Removing contaminants from the air.



Comfort Requirements

In addition to the fact that pool users are wet and wearing less clothing, they will also experience evaporation as they dry, which gives a cooling effect. As a result, higher than usual air temperatures need to be maintained. Evaporation also depends on the relative humidity in the air, but bathers are relatively tolerant of changes in humidity provided that air movement is minimised, for instance, by avoiding draughts.

Energy Flows

A pool needs heat to warm the water and air, and power (electricity) to drive the fans, the pumps, and to light the building. Some combination of heat and power is needed to dehumidify the pool hall air. The amount of heat and electricity used can be minimised, without compromising the performance of the pool, with good design, control and management.

It is easier to understand how to minimise energy use if one understands where the energy goes and why.

The main energy use in a pool is generated by the flow of moisture through the system. The warm pool water constantly evaporates into the air above, taking heat with it and cooling the pool. Heat must be added to the pool water to make up for this heat loss. The moisture coming in to the air must be removed to control the humidity levels in the pool hall air. This dehumidification process needs energy in fan power to move the air. It is therefore a good idea to reduce the evaporation from the water to reduce the whole cycle. Controlling this is therefore key to saving energy. The rate of evaporation from the pool depends on the difference between the moisture content of the air at the water surface, the moisture in the air just above the surface and also the air velocity.

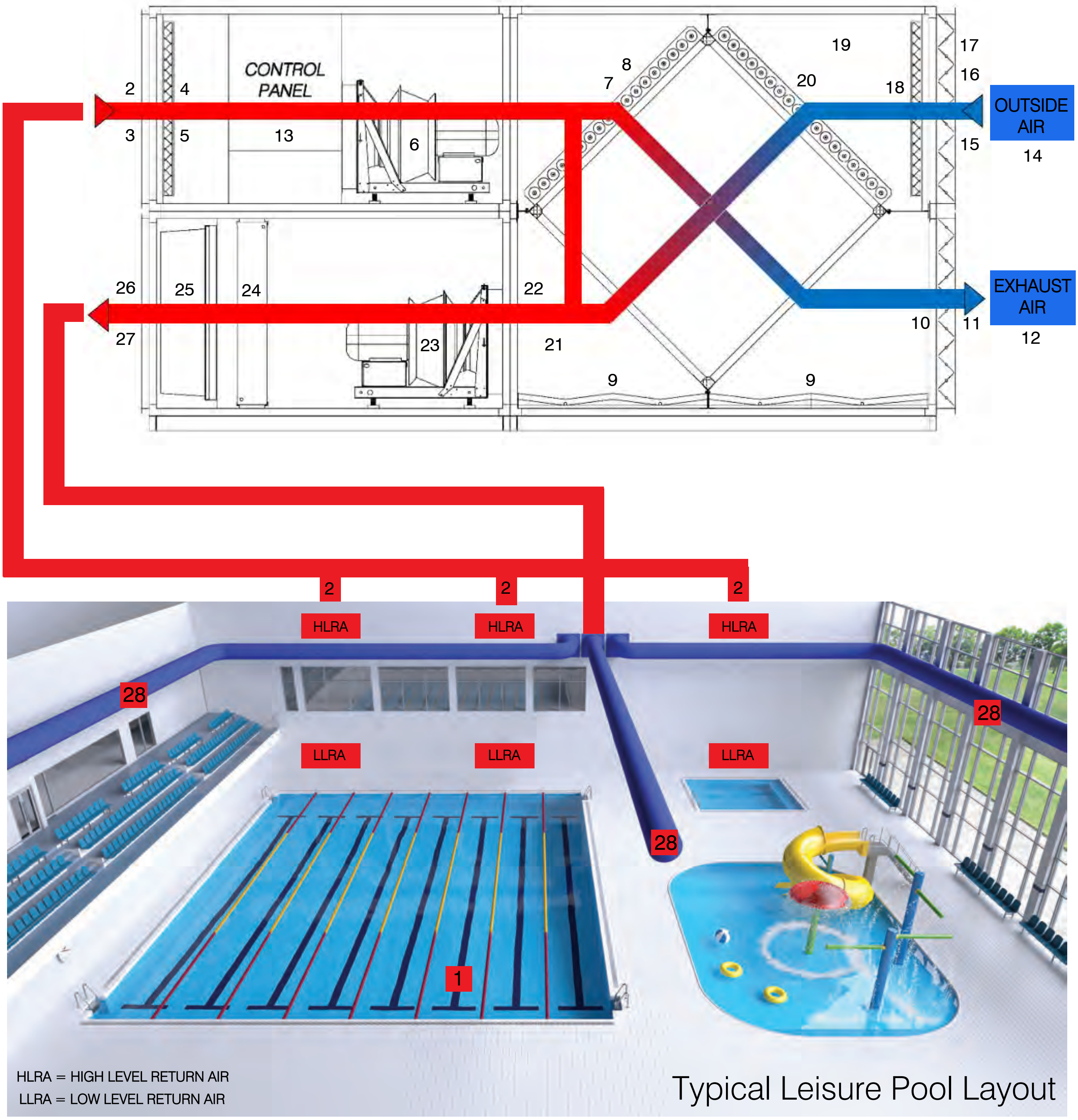
If the air above the surface can be as stationary as possible, it will become saturated and evaporation will be minimised. If the air moves, however, drier air will enter the space immediately above the pool, the moisture difference will increase and evaporation will increase. Thus the key to reducing evaporation is to minimise the air movement immediately above the pool. This will inevitably conflict with bathing activity in the area, so some evaporation will always take place when the pool is occupied. This is why the pool hall air must be continually heated even after it has been warmed up, to maintain bather comfort. There must be some movement of air from the water surface for this is needed to remove the potentially harmful chloramines and trihalomethanes that are a natural consequence of pool water disinfection.

As air temperature increases, it can hold more moisture in the form of invisible water vapour. Pool hall temperatures can hold more moisture than air at ordinary room temperatures, causing condensation to occur as the warmer, moist air moves over cooler surfaces.

Regardless of whether air flow patterns have been arranged to reduce evaporation, it is important to control moisture condensing on cold surfaces by limiting humidity.

Outside air normally has much less moisture in it than pool hall air as it has a lower temperature. Mixing outside air with pool hall air can reduce overall humidity. The outside air has to be heated up to the pool hall temperature to make it comfortable for bathers, which uses energy.

Recirculation of pool air, while conserving some energy, produces a risk of increased build-up of contaminants in the pool environment. Any recirculation introduced should, therefore, be carefully controlled (and the results monitored where possible) and/or restricted to periods when the pool is very lightly loaded or unoccupied, and when pool covers are in use to reduce evaporation.

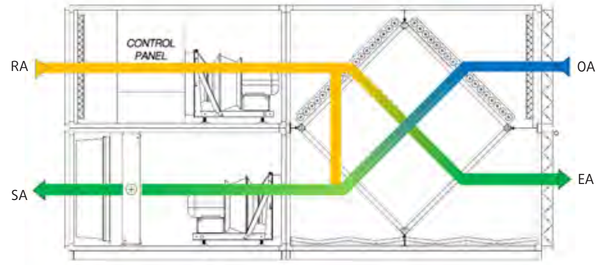


1) T/PI Water Temp Sensor °C (including POC/55/6 Stainless Steel immersion pocket)
2) Return Air from Pool Hall
3) Return Air CO2/T/H/S
4) Return Air Filter
5) Return Air Fan, Air Flow Movement Detector, Vane/Paddle Switch
6) Return Air Fan
7) Recirculation Airway Damper & Actuators
8) Crossflow Plate Heat Recuperator Pool Warm Air Exhaust Inlet Face
9) Condensate Drainage Sumps & Trapped Drains (4No)
10) Exhaust Air Volume Control Damper & Actuator
11) Exhaust Air Outlet
12) Outside Air
13) Integral Control Panel, Display & Keypad
14) Outside Air
15) Outside Air Inlet
16) Outside Air CO2/T/H/S
17) Outside Air Volume Control Damper & Actuator
18) Outside Air Filter
19) Outside Air Airflow Separation Plenum
20) Recuperator Bypass Airway Volume Control Damper & Actuators
21) Mixing Plenum, Bypass Air, plus Recovery Air equals Supply Air
22) Supply Air Fan, Air Flow Movement Detector, Vane/Paddle Switch
23) Supply Air Fan
24) Supply Air Heater. Heat Pump Coil
25) Supply Air Filter
26) Supply Air
27) Supply Air CO2/T/H/S
28) Supply Air Distribution System

Schematic 1

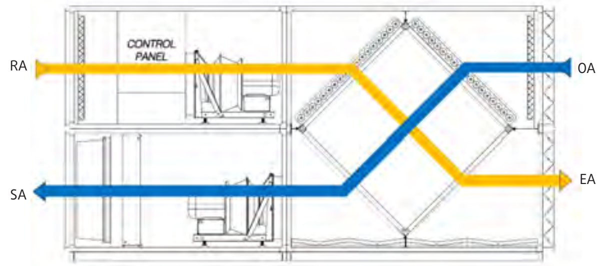
Operation when Pool is in use, autumn and spring

When the pool supervisor keys in "Pool in use" or the PIR sensors signal changes in air pressure, indicating movement, combined with infrared rays, indicating (body) heat the controls software computes that people are present and Modulates the EA,OA, and RN VCD's to 100% open increases air supply and extract, RA and SA fan speeds reduce to reduce evap cooling of users skin.



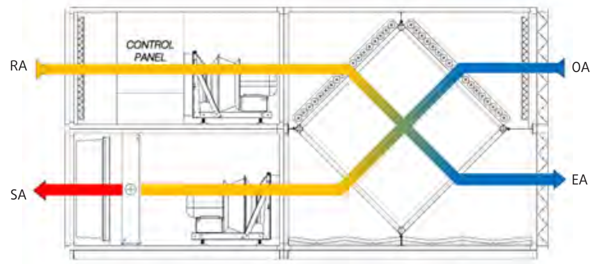
Schematic 2

Pool in use SUMMER. OA at design maximum OS conditions. Plant operation and air flows as schematic No 1 except 0% heat recovery from Return Air/Exhaust Air.



Schematic 3

Pool is in use WINTER. OA at design minimum conditions. Plant operation and air flows as schematic No 1 except 100% heat recovery from RC

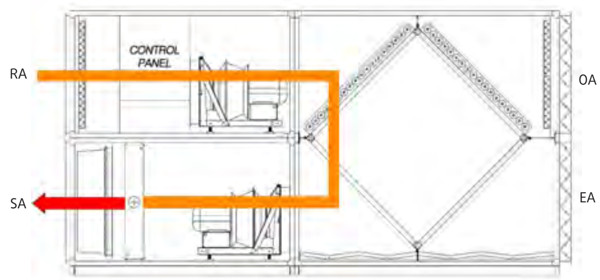


Schematic 4

Pool not in use in any season.
Hall air conditions within °C and %RH set point dead zone limits. Ahu plant operation and airflows set to: 100% recirculation at higher RA and SA volume, Plus LTHW heating.

When the PIR sensors in the hall have not, for a predetermined period, sent signals Indicating movement i.e. changes in air pressure.
Combined with infrared rays indicating (body) heat; Or the pool supervisor keys in "Pool not in use" Then the controls software computes that the pool is Not in use, and changes the AHU operation as follows:

The controls close the OA and EA VCD's, isolating the pool hall and air handling plant from possibly warmer or cooler OA, then move the single piece RC damper to 100% open, facilitating recirculation of pool hall air, move the single piece Recuperator recovery modulation (RRM) damper to shut off the Recuperator OA airway, then increase the RA and SA fan speeds to give the higher "pool not in use" recirculation air volumes which become acceptable when there are no pool users to suffer the discomfort of the increased cooling effect resulting from increased evaporation resulting from higher air velocity and lower pool hall temperatures allowed to save energy when the pool is empty The RA deg C sensor continues monitoring pool hall RA deg C and through the software varies the LTHW flow through the valve modulating the temperature of the LTHW coil finned block, hence varying the SA deg C to maintain the RA deg C within the room air temperature dead band.
The RA % RH sensor continues monitoring pool hall RA %RH and if this rises above its set point dead zone upper limit the controls change the AHU operation to "pool in use" See schematic No 1 above.



PXA3MX Explained

Heat Recovery Efficiency

Dependent on the right conditions, heat recovery efficiencies can be in excess of 90%. The correct efficiency is a subjective decision and depends on the economic calculation and written guidelines, i.e. Eco-design Commission Regulation (EU) No 1253/2014, on operating data such as energy prices, useful life, running times, temperatures, maintenance costs and interest rates. With regard to (EU) No 1253/2014, profitability and environmental protection the heat recovery efficiency should be no less than 73%.

Operation

Plate heat exchanger air handlers are configured either in a side by side or double stacked configuration. The warm extract air and the cool fresh air, separated by thin plates, pass each other in cross flow. No mixing of the two air streams takes place, therefore the transmission of dirt, odours, moisture, bacteria etc. is near on impossible. Heat is transmitted from extract air to fresh air purely by conduction as a result of the temperature difference between the two air streams. The warm extract air is cooled down; the cool fresh air is heated.

From the process, the specific heat output capacity depends on the temperature difference between the two air streams. Hence the plate heat exchanger is suitable for heat as well as coolth recovery. i.e. for winter and summer conditions.

The AHU air-mixing plenum combines two air streams. The configuration includes three sets of dampers: one for the fresh air, one for the exhaust air, and a mixing damper between the two air streams. The mix of fresh air and recirculated air can thus be adjusted to suit the needs of the building's occupants. Typically as the fresh air and exhaust air dampers are driven from 0% open to 100% open, the mixing damper will in turn be driven from 100% open to 0% open, so as to always ensure a constant volume of supply and extract air.

Basic Principles

ECE UK plate heat exchangers operate within the guidelines for heat recovery (e.g. Eurovent 10, VDI 2071) as recuperators with joint faces (category 1). The heat releasing and heat absorbing air streams pass along the joint face, through which the heat is directly transmitted. Supply and exhaust air must therefore be brought together and flow through the heat exchanger.

Transmission of moisture in the ECE UK plate heat exchanger is not possible as the two air streams are separated. When moisture is removed with the warm air from swimming pools this improves the system efficiency.

Condensation

ECE UK plate heat exchangers can use part of the latent heat of moist extract air. At low outside temperatures, when there is a high heat demand, the extract air is cooled down to such a degree that the saturation temperature is reached and condensation is formed. Thus the latent heat of evaporation is released. This reduces further cooling of the extract air, i.e. the temperature difference between the air streams in the plate heat exchanger is greater than when there is no condensation. Also the heat transfer is better; consequently the temperature efficiency is raised significantly.

Condensation in the extract air reduces the free area of the airway and is responsible for an increase in pressure drop. Therefore it is important that the condensation can drain away. This depends mainly on the fitting position of the heat exchangers and on the form of the plates.

Condensate drip trays are provided in both air streams supply and extract. The supply and extract fans are positioned in such a way that the pressure gradient is from the supply to the exhaust air. When large amounts of condensate are present in the extract air and the AHU air velocity is higher than 2.75 m/s, condensate drops can be carried along with the airflow and enter ducts or other ventilation components downstream of the heat exchanger. To avoid this and thus uncontrolled condensate escape, we recommend that a drop eliminator is installed after the plate heat exchanger.

Leakage Test

If condensation occurs the internal and external leakage of the exchanger is of particular importance. Even with a leakage rate of only a maximum of 0.1 % of the nominal air flowrate up to 3 litres condensate an hour can leak out, even more in extreme cases. ECE plate heat exchangers are 100 % leak proof as special measures are taken for swimming pool applications. By additional sealing, ECE UK can guarantee that the exchanger is delivered watertight in the tested installation position. Both the main air flow and bypass air flows are sealed off for leakage testing purposes.

Temperature Efficiency

In principle, nearly any temperature efficiency can be achieved if sized and designed to suit. For instance, the efficiency can be substantially raised by installing two exchangers in series. However, this increase in efficiency:

- Either is at the expense of a high pressure drop,
- Or at the expense of a large space requirement,
- And an increase in cost.

Performance Control

ECE UK plate heat exchanger operates as a temperature moderator between the two air streams. The direction of the heat transmission is of no consequence, i.e. depending on the temperature difference between extract and fresh air, either heat recovery or cool recovery takes place.

With the ECE plate heat exchanger the performance control through change of the mass flow ratio is simply and economically accomplished with the bypass.

Bypass In The Supply Air Stream

Depending on damper position, between 0 % and 100 % of the fresh air passes through the bypass. The extract air always flows through the heat exchanger and is cooled according to the fresh air flow rate. With this arrangement the cooling of the extract air and thus freezing can be avoided.

3-Way Mix

Plate heat exchanger with side recirculation bypass

Side recirculation bypass with dampers (USK)

Side recirculation bypass with dampers on the opposite side (YSK)

1. Face damper
2. Bypass damper
3. Recirculation damper

Heating with Recirculating Air

During pool not in use periods when the hall temperature is low, the recirculation air volume increases and the heating coil valve opens proportionally. The outside air and exhaust air dampers remain closed.

Dehumidification, Winter

The pool hall is being dehumidified by the introduction of outside air. During pool in use periods, a minimum proportion of outside air must be introduced in order to meet hygiene and air quality requirements. The outside air proportion is continuously adjusted according to the actual evaporation rate and the moisture content of the return air. Heating energy consumption is reduced by the high efficiency three stage Recuperator. The hot water coil valve opens proportionally according to the heating requirement.

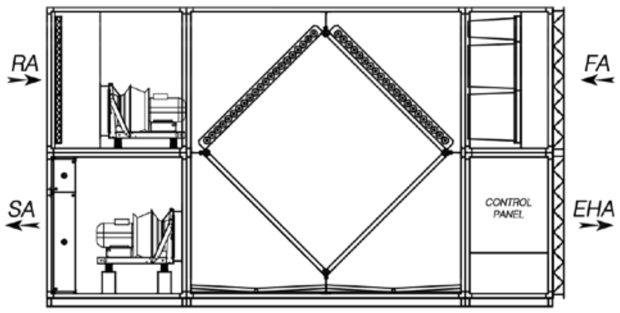
Dehumidification, Warmer Outside Temperatures

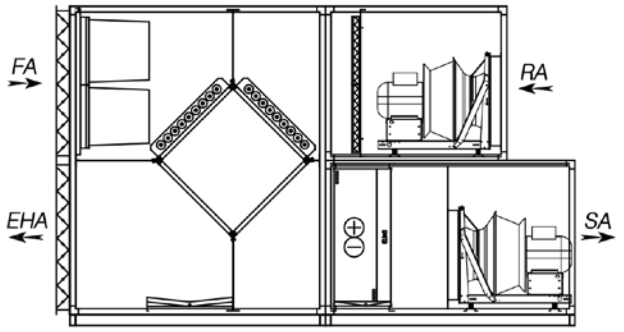
The pool hall is dehumidified using outside air and the recirculation damper is closed. The outside air bypass damper opens proportionally enabling partial heart recovery.

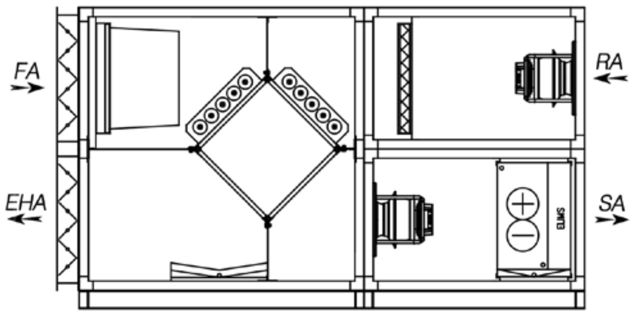
Dehumidification, Summer

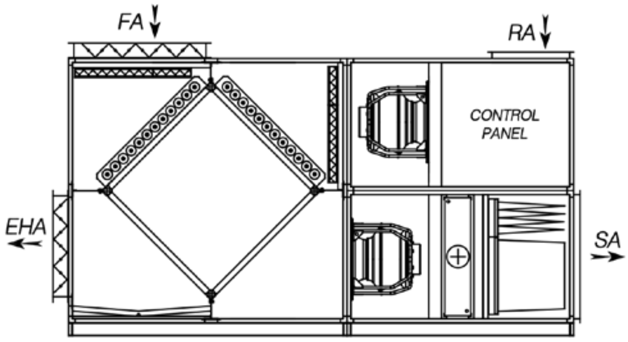
The pool hall is dehumidified using outside air. The outside air bypasses the Recuperator when no heating is required.

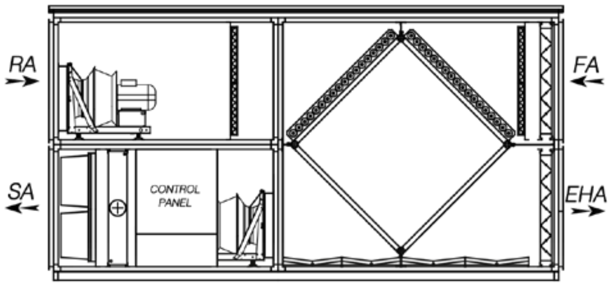
Popular PXA3MX Configurations











Selection Information

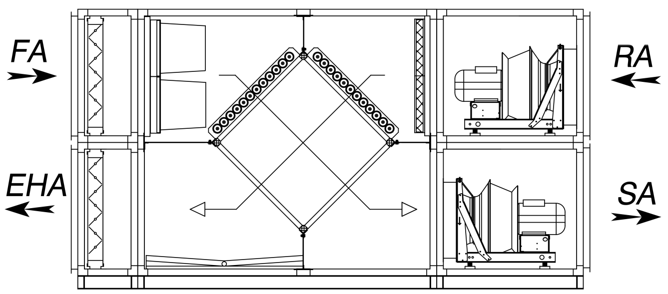
- Dimensions on page 18 & 19 are for roughing in only.
- To keep specific fan power (SFP) within ERP 2016 and L2 requirements, the following should be adhered too:
  - For AHU's with external system resistance <200Pa for both supply and extract systems, keep the face velocity between 2.5 and 3.0 m/s.
  - For AHU's with external system resistance between 200Pa –400Pa for both supply and extract systems, keep the face velocity between 2.0 and 2.5 m/s and, include 635mm long bag filters.
- Contact technical sales for specials if unit sizes are difficult to accommodate.
- Fan total pressures from 100Pa to 1500Pa are available (including AHU internal losses)
- Maximum external pressure available i.e. AHU inlet negative pressures plus AHU discharge positive pressure = fan static pressure less AHU internal component resistances for both extract and supply AHU's.
- Height and width dimensions in tables are the AHU frame outside dimensions. Add base dimension, also add roof dimension (RH1) if unit is external.
- Component length dimensions are space that each internal component occupies.
- Maximum overall AHU length unlimited. (Maximum single piece size subject to transport restrictions).
- Frame inlet connections generally 30mm up to size 5 and 50mm size 6 and above, around frame perimeter, undrilled.
- Inlet connections can be mezz flanges 30mm and 40mm as required.
- Outlet fan connections from unit – see dimension tables.
- If fresh air intake is at the bottom of the AHU and the supply sits at the top of the AHU, the extract section at the bottom of the AHU will need blank plenums to support the above supply.
- Individual section lengths including components like coils, attenuators or filters can range from 300mm to 2400mm. Each individual component does not have to sit within its own section.
- It is possible to have up to 4 stages of filtration on both the supply and extract air streams.
- "X" dimension will only be required if the supply or extract fan is downstream of a full face component, other than the plate heat exchanger.
- Due to ERP 2016, Level of filtration to always be F7 grade supply and M5 grade on extract.
- Gas heaters should be the last component in supply air configuration.
- Due to height restrictions, floor grid available from unit sizes 6 to 15 only. No need for floor grid if walk in access is not available.

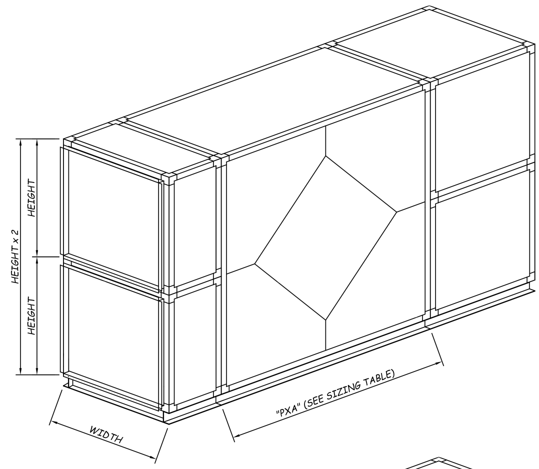
Velocity Chart

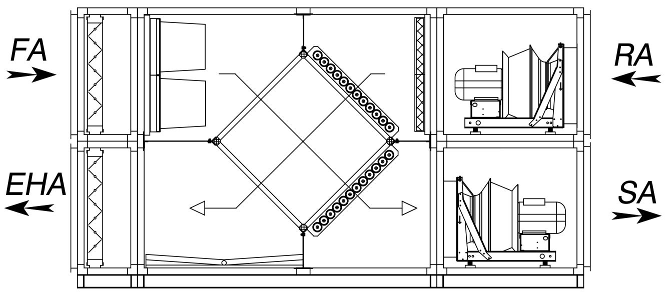
(Vc)m/s		Unit Size																
	VOLUME m^3/s AT COIL FACE VELOCITIES (Vc) m/s	1	2	3	4S	4	5	6	7	8	9	10S	10	11	12	13	14	15
1.75		0.36	0.52	0.75	1.09	1.09	1.52	2.16	2.55	3.14	3.99	4.85	5.33	6.47	7.99	9.47	10.98	12.10
2.0		0.42	0.61	0.87	1.2	1.2	1.85	2.54	2.98	3.65	4.64	5.6	6.18	7.51	9.5	10.82	12.53	13.8
2.25		0.47	0.68	0.97	1.35	1.35	2.09	2.86	3.35	4.12	5.22	6.3	6.95	8.44	10.69	12.17	14.09	15.53
2.5		0.52	0.76	1.08	1.5	1.5	2.32	3.17	3.73	4.56	5.81	7.1	7.73	9.39	11.88	13.53	15.66	17.26
2.75		0.58	0.83	1.19	1.65	1.65	2.55	3.48	4.1	5.02	6.39	7.7	8.5	10.32	13.07	14.88	17.23	18.99
3.0		0.63	0.91	1.3	1.8	1.8	2.78	3.8	4.47	5.48	6.97	8.4	9.28	11.27	14.25	16.23	18.79	20.71
3.25		0.67	0.99	1.41	1.95	1.95	3.01	4.12	4.85	5.94	7.56	9.1	10.05	12.2	15.44	17.58	20.36	22.44

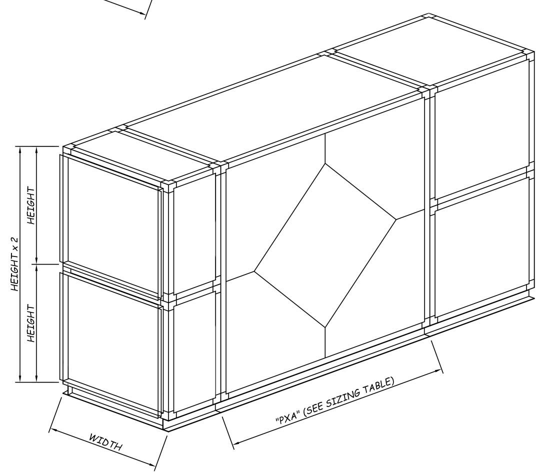
*Please select unit size from the above table using the velocity first, then to the nearest m^3/s value to your required air volume.
**Reduce Velocity, Increase unit size is the preferred final selection.

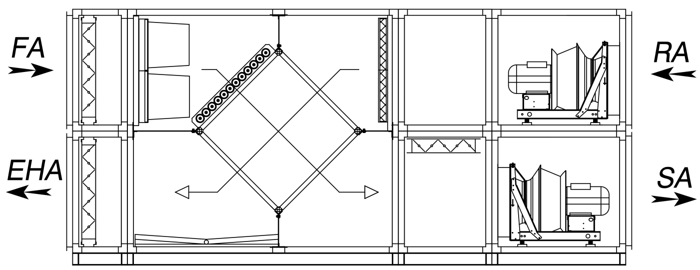
Base Models

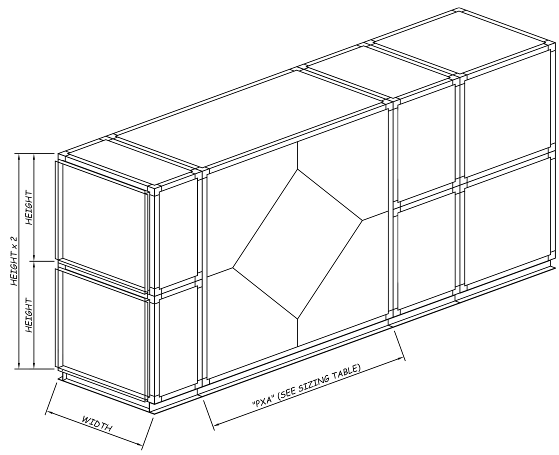






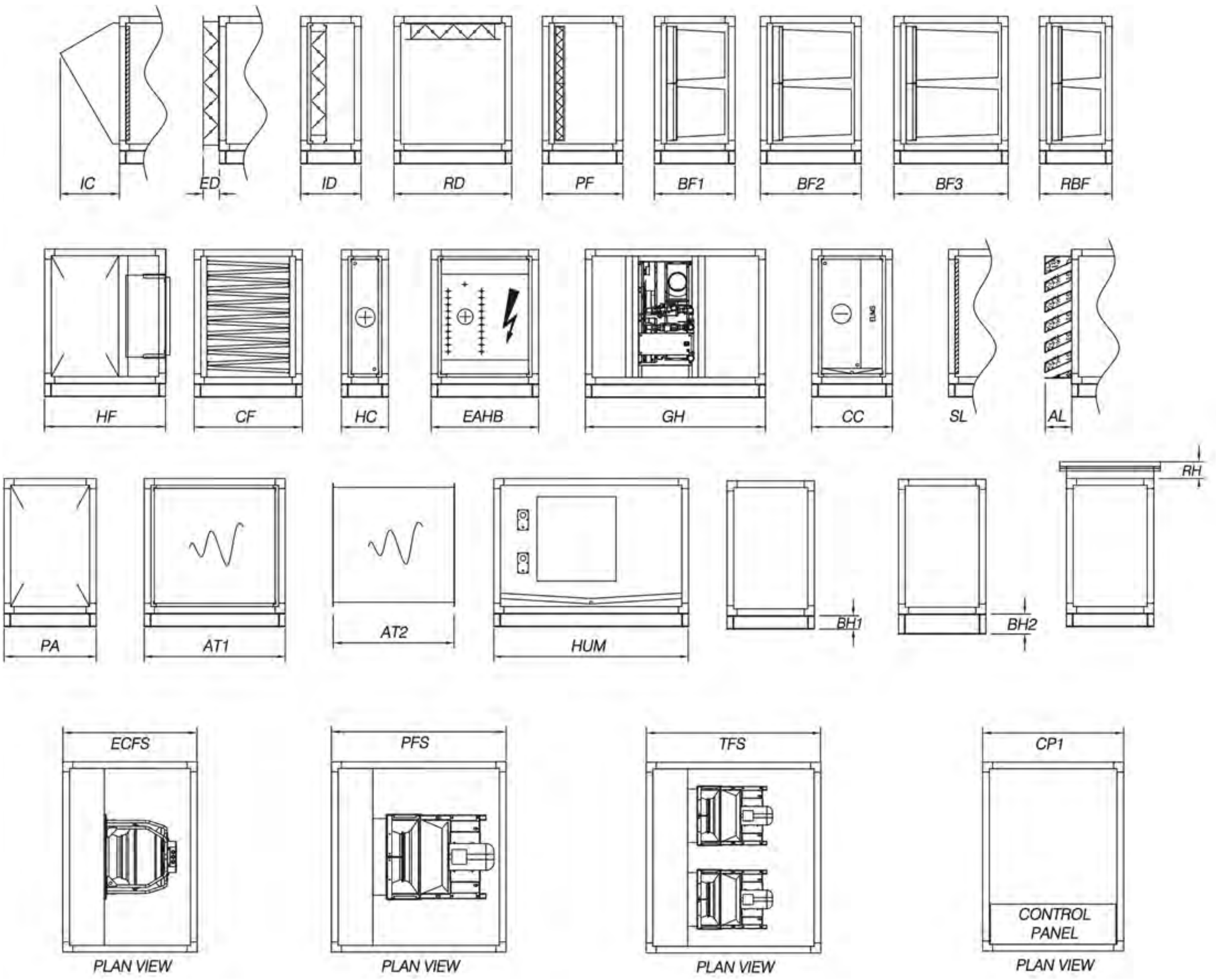




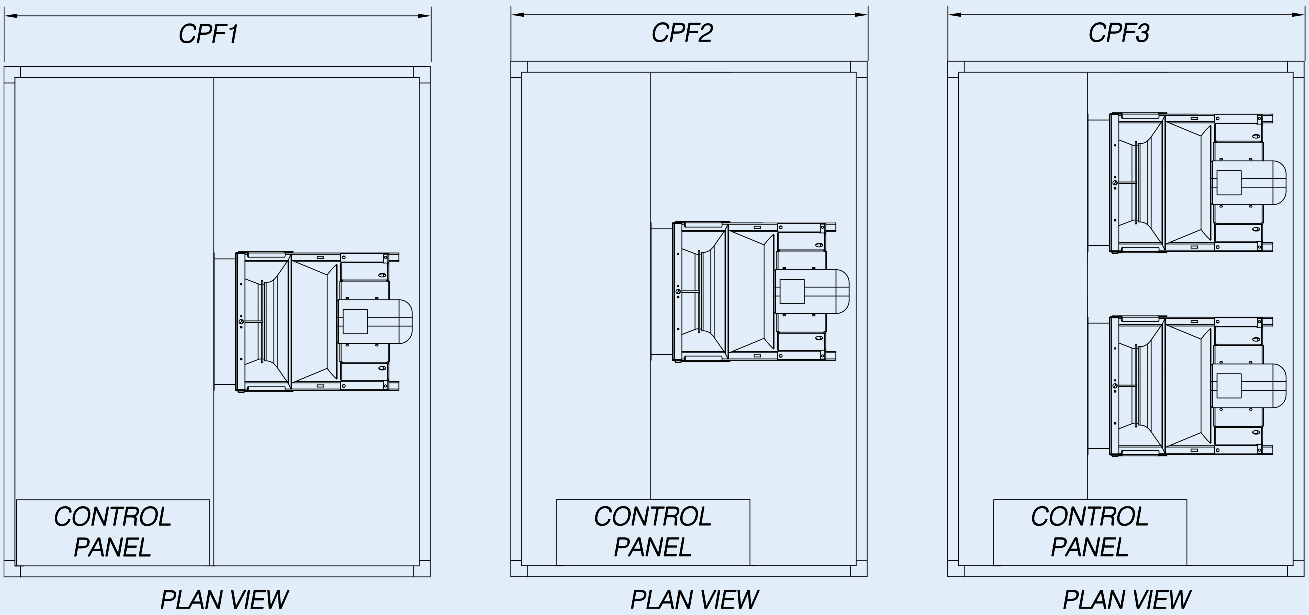


Base models shown are internal FA & EHA dampers for external units, AHU length will reduce by 200mm with external dampers and internal units

AHU Components



Fan & Control Configurations



Dimension Table

Dim	Size	1	2	3	4S	4	5	6	7	8	9	10S	10	11	12	13	14	15
	Additional Components Height & Width																	
H	Height 25mm Panels	610	730	730	1020	730	1020	1360	1360	1360	1670	1970	1670	1970	2400	2400	2400	2400
W	Width 25mm Panels	690	780	1010	1010	1310	1310	1360	1560	1860	1860	1860	2400	2400	2400	2800	3200	3500
H	Height 50mm Panels	650	770	770	1060	770	1060	1360	1360	1360	1670	1970	1670	1970	2400	2400	2400	2400
W	Width 50mm Panels	730	820	1050	1050	1350	1350	1410	1610	1910	1910	1910	2450	2450	2450	2850	3250	3550
	Double Stacked PXA Height																	
-	Double Stacked PXA Height 25mm	1220	1460	1460	2040	1460	2040	2720	2720	2720	3340	3940	3340	3940	4800	4800	4800	4800
-	Double Stacked PXA Height 50mm	1300	1540	1540	2120	1540	2120	2720	2720	2720	3340	3940	3340	3940	4800	4800	4800	4800
	Side by Side PXA Height																	
-	Side by Side PXA Height 25mm	610	730	730	1020	730	1020	1360	1360	1360	1670	1970	1670	1970	2400	2400	2400	2400
-	Side by Side PXA Height 50mm	650	770	770	1060	770	1060	1360	1360	1360	1670	1970	1670	1970	2400	2400	2400	2400
	Additional Component Lengths																	
PXA	Plate Heat Exchanger	1800	1800	1800	2000	2000	2000	2400	2400	2400	2400	2700	2700	2700	3000	3000	3000	3000
IC	Inlet Cowl	200	250	250	250	250	400	550	550	550	700	700	700	700	700	700	700	700
ED	External Damper	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120	120
ID	Internal Damper	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450	450
RD	Re-Circulating Damper	400	500	600	600	600	600	900	900	1100	1100	1400	1400	1400	1400	2000	2000	2000
PF	Panel Filter	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
BF1	Bag 380 - BS EN 16980	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600
BF2	Bag 535 - BS EN 16890	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750	750
BF3	Bag 635 - BS EN 16890	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850	850
RBF	Rigid Bag Filter	550	550	550	550	550	550	550	550	550	550	550	550	550	550	550	550	550
HF	HEPA Filter	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900
CF	Carbon Filter	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900
HC	Frost / LPHW / Pre / Re Heater	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250	250
EAHB	Electric Air Heater Battery	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900	900
GH	Gas Heater	1200	1200	1200	1200	1200	1200	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
CC	Cooler, DX or CH.W	550	550	550	550	550	550	550	550	550	550	550	550	550	550	550	550	550
SL	Standard Louvre	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
AL	Acoustic Louvre	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300	300
PA	Plenum / Access	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600	600
AT1	Attenuator	1050	1050	1050	1350	1350	1350	1350	1350	1350	1350	1650	1650	1650	1650	1650	1650	1650
AT2	Duct Mounted Attenuator	900	900	900	1200	1200	1200	1200	1200	1200	1200	1500	1500	1500	1500	1500	1500	1500
HUM	Humidifier	1200	1200	1200	1200	1200	1200	1200	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600
BH1	Base Height	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100
BH2	Base Height	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150	150
RH	Roof Height	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125	125

Dimensions are for roughing in only

Dimension Table

	Unit Size																
	1	2	3	4S	4	5	6	7	8	9	10S	10	11	12	13	14	15
ECFS - EC Fan Sect	900	900	900	1200	900	1400	-	-	-	-	-	-	-	-	-	-	-
PFS - Plug Fan Sect	900	900	900	1200	900	1300	1500	1500	1500	1900	1900	1600	1600	1600	1800	2100	2100
TFS - Twin Fan Section	-	-	-		-	-	-	1200	1400	1400	1400	1600	1600	1600	1800	2100	2100
CP1 - Control Panel Enclosure	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800	800
CPF1 - Controls Panel Fan Sect	1700	1800	1800	1800	-	-	-	-	-	-	-	-	-	-	-	-	-
CPF2 - Controls Panel Fan Sect	-	-	-	-	1200	1300	1300	1500	1700	1700	1700	1700	1700	1700	1700	1700	1700
CPF3 - Controls Panel Fan Sect	-	-		-	-	-	-	-	-	1900	1600	1900	1600	1600	1800	2100	2100

AHU Component Dry Weights kg

		1	2	3	4S	4	5	6	7	8	9	10S	10	11	12	13	14	15
PXA	Plate Heat Exchanger	416	469	538	669	669	812	1069	1167	1273	1506	1851	1851	1960	2222	2336	2450	2540
IC	Inlet Cowl	4	6	7	9	9	13	17	20	24	29	37	37	44	54	63	72	79
ED	External Damper	16	20	23	29	29	37	45	51	62	76	104	104	120	172	196	220	240
ID	Internal Damper	50	58	66	78	78	92	105	116	134	153	193	193	215	276	308	341	368
RD	Re-Circulating Damper	46	62	81	95	95	110	166	182	238	265	420	381	418	497	698	760	810
PF	Panel Filter	32	38	46	51	51	57	63	77	84	91	111	111	126	142	189	211	227
BF1	Bag 380 - BS EN 16980	80	90	106	131	131	142	158	175	191	220	252	252	277	310	351	387	416
BF2	Bag 535 - BS EN 16890	80	90	106	131	131	142	158	175	191	220	252	252	277	310	351	387	416
BF3	Bag 635 - BS EN 16890	80	90	106	131	131	142	158	175	191	220	252	252	277	310	351	387	416
RBF	Rigid Bag Filter	81	91	107	132	132	143	159	176	192	221	253	253	278	311	352	388	417
HF	HEPA Filter	88	102	126	155	155	182	206	223	253	297	364	364	409	466	551	607	660
CF	Carbon Filter	119	164	219	279	279	368	454	471	563	669	891	891	1060	1210	1512	1692	1838
HC	Frost / LPHW / Pre / Re Heater	46	53	64	75	75	91	106	120	138	158	193	193	219	253	281	315	341
EAHB	Electric Air Heater Battery	46	53	64	75	75	91	106	120	138	158	193	193	219	253	281	315	341
GH	Gas Heater	84	97	107	140	140	167	177	235	246	263	290	290	300	315	465	481	493
CC	Cooler, DX or CH.W	88	94	141	180	180	236	296	348	409	488	622	622	728	880	991	1129	1231
SL	Standard Louvre	4	6	7	9	9	13	17	20	24	29	37	37	44	54	63	72	79
AL	Acoustic Louvre	24	26	27	29	29	33	37	40	44	49	57	57	64	74	83	92	99
PA	Plenum / Access	75	84	96	110	110	122	135	146	160	172	198	198	213	232	251	270	285
AT1	Attenuator	107	123	147	174	174	212	252	287	324	375	460	460	523	612	715	819	876
AT2	Duct Mounted Attenuator	140	161	193	229	229	279	332	378	427	495	606	606	691	808	945	1083	1158
HUM	Humidifier	109	118	130	144	144	190	203	214	228	274	375	375	421	450	530	559	582
BH1	Base 100mm High 1000L	6	6	6	6	6	6	10	10	10	10	15	15	15	15	15	20	20
BH2	Base 150mm High 1000L	7	7	7	7	7	7	11	11	11	101	16	16	16	16	16	22	22
RH	Roof Section 1000L	10	11	14	17	17	17	18	19	23	23	28	28	28	28	32	36	40
	Floor Grid 1000W	-	-	-	-	-	-	24	24	24	34	43	43	43	43	51	58	63
	25mm Acoustic Treatment	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5	5
	50mm Acoustic Treatment	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10	10
Water	Weight of water in coils (kg) = 5.3 x face area m² x number of rows. Cooling generally 4-6 rows, heating generally 1-2 rows.																	

Controls Partner

Heat Recovery Efficiency

As part of our PXA3MX range of Air Handling Units we are able to supply our Intelligent Energy Control (IEC) system.

The IEC system is powerful, flexible, user-friendly and specifically designed to provide a complete control solution for Air Handling and Conditioning Systems.

At the heart of our IEC solution is the fully programmable IQ4 controller which is housed within an IP65 enclosure.

Further to this our IEC system will interface with many manufacturers equipment including but not limited to Mitsubishi, Daikin, Toshiba, Samsung and Panasonic and has the facility to support many protocols; these include Modbus, BACnet, LonWorks, and SNMP.

As of the 1st of June 2018 our customers who purchase the IEC system will receive a 5-year limited hardware Warranty on our IQ4 controllers and modules.

Forward Thinking

As a controls partner we strive to maintain a position at the forefront of technology, and have developed considerable expertise in manufacturing both the hardware and software that makes up the Intelligent Energy Control system.

The greatest advantage ECE has from being able to design and manufacture the software and hardware, is that it greatly strengthens the company's ability to set the technological innovation and design standards throughout our industry.

Two of our latest IEC technological developments benefiting our customers are Economy Mode and Intelligent Frost Protection.

Economy Mode

Economy Mode has three stages of system efficiency including economy cycle, free cooling and energy recovery.

This system can offer incredible savings to end users and reduce air handling unit motor energy consumption by up to 50%.

Intelligent Frost Protection

Our Intelligent Frost Protection will monitor internal condition of the building during night shutdown and protect the building fabric. The units will achieve this by running for short periods every two hours (user adjustable) to read the return air temperature. If after 10 minutes of operation the return air temperature is above the non-occupied temperature set point the unit will be disabled until the next start cycle.

If any of the units read a temperature below the minimum non-occupied temperature set point, that unit will operate until the return air temperature rises above the non-occupied temperature set point.

ASHRAE BACnet™ TREND OEM Partner

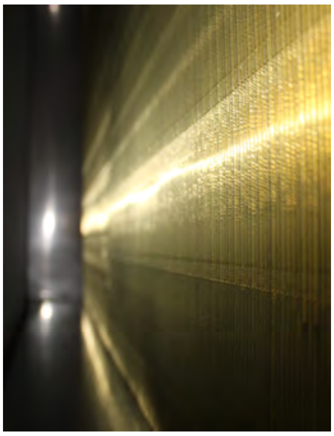
Air Handling Unit Construction

Built To Last

At ECE UK we have improved the design of our equipment over the last forty years offering a cost-effective solution including L2 Leakage Class, D1 Deflection Class, TB1 Thermal Bridging and T2 thermal Transmittance. This is complimented by achieving standards set out in ERP 2016/18 and L2 Specific Fan Power.

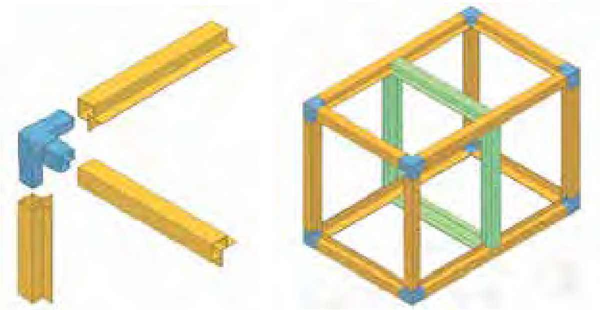
A unit constructed to resist the effects of corrosion caused by a swimming pool environment would include:-

- Stainless steel filter frames
- Stainless steel drain trays
- Coils manufactured with vinyl coated aluminium or copper electro-tinned fins, and stainless steel case surround
- Epoxy painted dampers
- Epoxy painted Recuperator
- Epoxy painted fans
- Plastisol inner skin



To further ensure structural stability, rigidity and thermal qualities BS EN 1886:2007 standard provides the means for classifying the performance of all our air handling units.

The Air Handling Unit framework is constructed from a closed aluminium box section with heavy duty injection moulded ABS black nylon knock in corner pieces. This high density and lightweight structure ensures a strong and rigid framework for the Air Handling Unit.



Depending upon the project requirements panels can be either 25mm or 50mm thick. Panels are constructed from a plastisol coated sheet steel inner skin with a plastisol coated sheet steel outer skin with mineral wool insulation sandwiched between the sheets. Our standard plastisol colour is Goosewing Grey RAL10A05, other colours are available on request.

Our standard mineral wool insulation has a density of 100kg/m3.

As standard each complete unit or modular section would be factory assembled on a full perimeter base to ensure full structural stability.

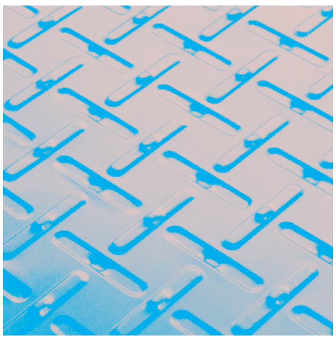
All externally mounted units would be fully sealed and completed with an overhanging pitched roof to prevent water ingress.

Depending upon site access all of our Air Handling Units can be supplied as modular sections, component form or fully assembled on a single piece base frame and still conform to the standards set out above.

PXA Plate Structure

Exchanger Package In DesignsS

The exchanger package consists of specially formed aluminium plates. Their profile with V-shaped spacing ribs is an optimum design resulting from detailed tests for temperature efficiency, pressure drop and rigidity.



The special profiles of our plates are the result of extensive tests and measurements (design S shown here).

Specification Texts

DesignsS

ECE UK cross-flow plate heat exchanger for heat recovery, consisting of exchanger package and casing: The exchanger package consists of aluminium plates with pressed-in spacers; condensate drainage is possible in every direction, depending on the installation position.

The plates are connected by a fold, which gives a several fold material thickness at air entry and exit. The corners of the exchanger package are sealed into especially rigid aluminium extrusions in the casing with a sealing compound. The side walls of Aluzinc sheet steel are bolted tightly to these extrusions.

ECE UK plate heat exchangers are suitable for temperatures ranging from -40°C to 90°C.

All performance data is Eurovent-certified by Eurovent and RLT (TÜV Süd). Dry temperature efficiencies up to 80 % can be achieved. The exchangers are resistant to up to 2500 Pa pressure difference between the air streams.

Designs G (Corrosion Protected)

The exchanger package consists of aluminium plates, the casing of aluminium extrusions and side walls of Aluzinc sheet steel all powder coated suitable for a pool environment.

Plate heat exchanger corner sections are aluminium powder coated. The exchanger sealing is silicone free 2 component adhesive.

The exchangers are silicone-free. The maximum permissible temperature is 90 °C (design S). Series G is used when large amounts of condensate occur and specific for swimming pool applications.

Control Damper

To regulate the airflow through the bypass or the exchanger, opposed control dampers are necessary. The dampers have the following special features:

- Damper's air leakage flow rate complies with class 2, BS EN 1751.
- Damper casing Aluzinc sheet steel and powder coated.
- Damper blades are galvanised sheet steel powder coated.
- Damper bearings, end caps and gear wheels are polypropylene.
- Driving plastic gear wheels are fitted in the middle, i.e. between the bypass and the heat exchanger.
- Gear wheels are protected from the air stream.
- Blades consist of rigid profiles and are therefore particularly tight.
- Maximum torque allowed is 20 Nm.
- Damper shaft can be installed at any blade on either side of the damper. To ensure an optimum torque transfer installation at a blade in the middle of the damper is recommended.
- Maximum temperature for the damper and adapter H is 80°C.

Safe use of Stainless Steel in Air Handling Units for Swimming Pool Environments

Indoor swimming pools are among the most demanding built environments today, with high levels of temperature, humidity and corrosion load emanating from disinfection chemicals and their reaction products. Hence, the Air Handling Unit materials and finishes used should be suitable for the intended application and able to withstand these conditions while ensuring hygiene and preventing bacterial growth.

Contrary to common belief, the most ad- verse corrosion conditions are not found in direct contact with swimming pool water but in the atmosphere above the pool.

Typical conditions found in indoor swimming pools are:

- Air temperature usually 0–4 °C higher than pool water temperature;
- Relative humidity between 40 % and 80 %, ideally under 60 %
- Air speed in proximity of users $<$0.10 m/s.

Indoor swimming pools disinfected with chlorine

Temperature fluctuations in indoor swimming pools that, result in cycles of evaporation, condensation and drying, generate a highly corrosive environment due to the accumulation of various chloride bearing compounds in the atmosphere. Therefore it is important to make a clear distinction between those items of equipment that can be cleaned regularly.

In general, well-chosen stainless steel elements in the AHU which are easily accessible and not safety critical can be effectively maintained and are protected against staining and pitting by washing down monthly.

Air handling unit components that are regularly cleaned

Like all pieces of equipment used for a swimming pool environment an air handling unit should always be subject to regular cleaning, and because of this the following stainless steel grades are suitable:

- 1.4401 (X5CrNiMo17-12-2)
- 1.4404 (X2CrNiMo17-12-2)

Steel Designation		Approx. AISI / ASTM	C	CR	Ni	MO
Name	Number		% by mass			
X5CrNiMo17-12-2	1.4401	316	≤0.070	16.5-18.5	10.0-13.0	2.0-2.5
X2CrNiMo17-12-2	1.4404	316L	≤0.030	16.5-18.5	10.0-13.0	2.0-2.5

Furthermore, it should be specifically noted that the painting of stainless steel surfaces does not provide additional protection against corrosion. Paint can spall off and form crevices which are prone to corrosion. Organic coating cannot justify the selection of a lower alloyed grade.

Development of a Surface Finish Standard

British Steel carried out an extensive programme of polishing trials, in conjunction with various stockholders/polishers, using different polishing grits and belt types. Samples from each of these trials were submitted to a 21-day accelerated cyclic salt spray test at Swindon Laboratories. The results clearly showed that surface roughness had a controlling influence on the degree of surface staining with 'coarse' polished finishes (Ra $>$ 1.0 micron) showing high levels of staining, whereas 'smooth' polished finishes (Ra $<$ 0.5 micron) showed little staining, after the 21 day test period. SEM examination confirmed the previous work, carried out in the late 1970's, with the heavily stained sample (Ra $>$ 1.0 micron) exhibiting considerable surface damage from the polishing treatment. In contrast, the unstained smooth sample (Ra $\sim$ 0.3 micron) showed only minimal surface damage from the polishing operation.

When the European Standard EN10088-2 was drawn up in the mid 1990's, the No 5 finish was re-designated as a 2K surface finish, but it still carried the most important requirement that the transverse Ra value should not exceed 0.5 microns.

Importance of Surface Finish in the use of Stainless Steel in Air Handling Units

It has long been recognised that the surface finish on stainless steel has an important effect on its corrosion resistance. The mere specification of 1.4401 (316) type stainless steel for air handling units in swimming pool applications is not in itself sufficient.

316 stainless steel contains an addition of molybdenum that gives it improved corrosion resistance. This is particularly apparent for pitting and crevice corrosion in chloride environments.

Directional ‘dull’ polished finishes can exhibit a wide range of surface roughness dependent upon the type of belt and polishing grit that has been used. Coarse polished finishes, with transverse Ra values (surface roughness) > 1 micron, will exhibit deep grooves where chloride ions can accumulate and destroy the passive film, thereby initiating corrosion attack.

In contrast, fine polished finishes with Ra values < 0.5 micron will generally exhibit clean-cut surfaces, with few sites where chloride ions can accumulate.

As manufacturers our stainless steel products such as drain trays and filter frames are manufactured using a Bright Polish finish with a surface roughness of 0.05 micron.

The importance of stainless steel being cleaned and pickled after processing

Stainless steel owes its corrosion-resistant properties to its natural capacity to form a protective oxide layer. After stainless steel has been processed as for example by cutting, sawing, drilling, bending, welding etc., the oxide layer on the stainless steel has been damaged or is absent in whole or part.

When the oxide layer is not restored (by pickling the stainless steel) one might as well use carbon steel. Stainless steel rusts too when it is not treated after being processed.

Welding and Pickling

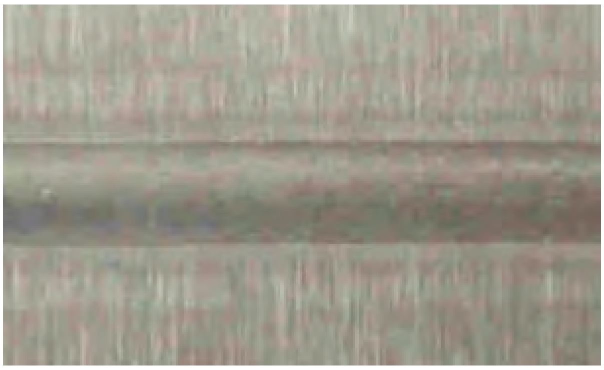
Welding causes oxidation on and next to the weld seam, both internally and externally. This is visible as a coloured zone and causes a reduction of the resistance to local corrosion.

A post-treatment such as pickling is applied after welding to remove the oxidized layer (discolouration) and to improve corrosion resistance.

Pickling is the only post-treatment that will restore the corrosion resistance of the weld to what it was prior to welding. This is true irrespective of the type of stainless steel and there is no difference in effectiveness between immersion Or application of a pickling paste (Practical recommendation No. LM.94.04 NIL, Dutch Institute for Welding Technology).

Before picking

After picking



Asset Information

This AHU mounted web based portal augments our customer experience by providing you with all your BIM Level 2 files for your job specific, bespoke, Air Handling Unit as defined at the design stage.

This allows building maintenance teams, consultants and contractors unique access to one of the most productive portals available.

Here is just some of the great features that our portal offers:

- 3D models to go into your Building Management System, such as Revit (.step, .sat, .ifc, .dwg (3D), etc.)
- 3D models that can be interacted with in real-time using augmented reality devices (such as a Microsoft HoloLens)
- 2D Certified Drawings (.dwg for loading into AutoCAD /DraftSight and .pdf for opening on any device, anywhere)
- Consumables Information (such as Filters, Motors, Sensors and Actuators)
- Single click Basket for consumables with Anything Air Handling, our Spares & Parts shop www.aahuk.com
- Controls Documents (if your AHU has one of our controls package)
- Refrigeration Unit Information
- Installation, Operation and Maintenance Manual
- Recycling Manual

All you need to access this information is a unique reference number and an email address. To make it really easy each of our units now come with an Asset Information plate allowing you on-premises access to all the information from your mobile device.

TRY IT! Scan the QR and enter the code

Fred and Jeans aim was to design, manufacture and sell air handling units from their factory in the Kent countryside village of Eynsford. The air handling unit requirements of many corporate clients were secured in those early days; these included Tesco; the AA; Safeway and BUPA. After nearly eleven years the company relocated to a larger factory and offices in Harvel. It was here that Fred and Jeans son Simon Hull joined the business and began working in each of the factory and office departments.

As the company grew more diverse clients were secured including many hospital trusts which have proved to be a mainstay of the business. With the approach of the new Millennium the company name was changed to ECE UK Ltd as this was how the company had become known by many clients. In May 2007, after the company moved again to larger premises, Simon Hull took over the day to day running of the business and became Managing Director.

ECE has always been more than just a family business. Throughout its history, ECE has maintained a personal approach when working with clients. Many clients have been with ECE since the beginning and it is this ability to retain clients and continue to deliver excellent products, service and value that provides a solid base for the ongoing expansion.

"Choose Craftmanship and Knowledge"

References and Contributors

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2. **Pool Water Treatment Advisory Group (PWTAG) Code of Practice for Swimming Pool Water** – 2016 Updated to reflect the requirements of Managing Health and Safety in Swimming Pools (HSG179).
3. **Swimming Pool Water Book** – Treatment and quality standards for Pools and Spas (PWTAG)
4. **Getting the best out of Stainless Steel** – British Stainless Steel Association.
5. **Safe Use of Stainless Steel in Swimming Pool Environments** – (Building Series, Volume 20) The European Stainless Steel Association.
6. **Stainless Steel in Swimming Pool Buildings** – Nickel Institute.
7. **Importance of Surface Finish in the Design of Stainless Steel** – Swinden Technology Centre and British Stainless Steel Association.
8. **Appendix 1 Pool Types and Technical Design Issues** – Sport England (Design Guidance Note).
9. **Appendix 2 Servicing the Building** – Sport England (Design Guidance Note).
10. **Swimming Pools (Updated Guidance for 2013)** – Sport England (Design Guidance Note).

AAH
anything air handling

TREND
OEM Partner

Did you know...?

- on a DX system the indoor coil is mounted internal to the AHU and outdoor coil is the condensing unit?
- when matching indoor to outdoor coils HEX volume, Air Volume, Coil Capacity and Coil Circuitry should match?
- at peak times during summer and winter, outdoor coil capacities on DX systems can reduce by up to 20%. Dependent on ambient temperatures?
- minimum air on temperature in heating mode for a DX system indoor coil is 10°C?
- swings in temperature are often caused by DX run on times and single circuit DX systems supplying small areas. This is more prevalent in small areas and with air volumes below 1.0 m^3/s. Twin circuits will often reduce the risk of this happening?
- by supplying twin circuits you reduce the risk of cold air being pumped into the area served when one circuit is in defrost?
- some DX units have eleven capacity steps whereas others may only have five?
- the term "vertical unit" has the same meaning as double stacking and or piggy back arrangement?
- if you're concerned about the equipment access route, ECE can offer a free site survey?
- ECE can offer a long reach HIAB vehicle with a reach of 27 meters holding one tonne?
- if ECE supply the AHU, Controls and DX equipment the AHU warranty is extended to two years?
- ECE offer a 5 year warranty on its iQ range of controllers?
- ECE offer a 5 year warranty on its DX units?
- ErP requires supply systems to have minimum ePM 2.5 50% grade filtration?
- AHU Location can be Internal or External
- Delivery can be in modules or packaged in one piece (dimensions limits apply)
- Units also available "Dry Built" for site off load, dismantle, carry through, re-assemble, join and seal
- Units also available in component form for site offload, carry through, re-assemble, join and seal
- Fewer pressure producing components reduces the overall energy consumption thus reducing carbon footprint, SFP and running costs of the AHU.
- AHU cooler and heater duties will incorporate coolth and heat recovery capacity and reduce the size of the indirect or direct heating and cooling equipment. This will reduce the indirect or direct heating and cooling equipment cost to the client by up to 20%.
- AHU's can include EC Fans (IE4 Motors) to give the highest possible efficiency and the lowest life cycle cost.
- By removing the frost coil this increases heat recovery efficiency as the delta t between return air and fresh air is greater. Thus more energy is available for recovery.

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