

Ecogreen[®]

Heat Pumps & Heat Recovery

AIR-to-WATER & WATER-to-WATER HEAT PUMPS

Pedro Machain

CEO Ecochillers Corporation

Diary

- Why do we create this product?
- What do we create?
- In greater depth
- Questions and answers

Design strategy:

Get a jump on the competition by solving the problems they cannot or do not want to solve.

- ① Prioritize reliability in operation
- ② full Serviceability.
- ③ Effort to obtain all components from America and Europe
- ④ Customization options
- ⑤ Introduction of connectivity to renewable energy sources

○ What do we create?

A platform designed around semi-hermetic reciprocating compressors.

- ① 25 ton cooling circuit(s) by reciprocating compressor with units up to 200 tons
- ② Screw compressor systems from 60 to 240 tons per structure.

Simultaneous heat pumps/ 4 tubes from 25 to 200 tons on the Reciprocating Compressor Platform.



What we have created

Low GWP Refrigerant 513A

- ① A1 which is low toxicity and non-flammable
- ② Low global warming potential at 630GWP
- ③ Azeotropic blend of HFC R134a (44%) and HFO R1234yf (56%) with zero slip



Designed to achieve the minimum efficiency of ASHRAE 90.1 std. 2019

Special features like:

- * Adiabatic precooling
- * Renewable energy
- * Custom hydronic packages



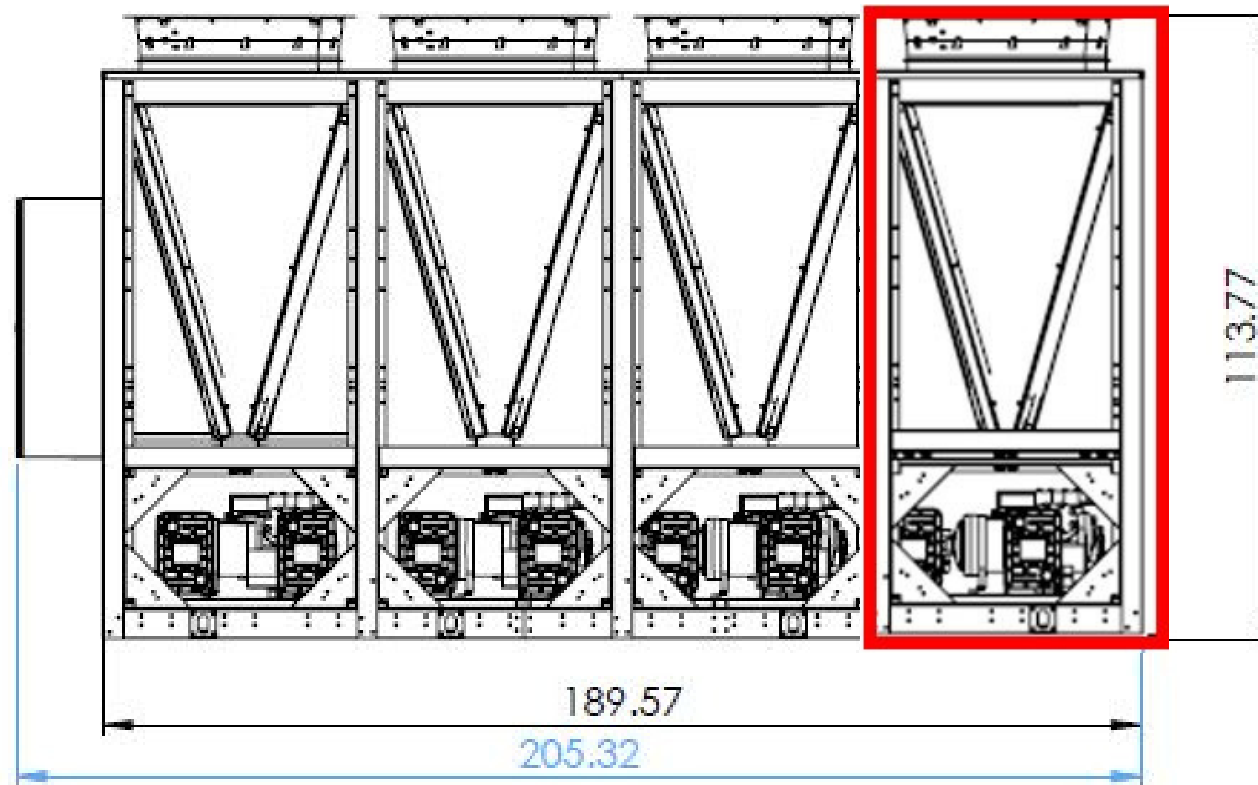
Table 6.8.1-16 Heat-Pump and Heat Recovery Chiller Packages—Minimum Efficiency

Equipment Type	Size Category, ton _s	Cooling-Only Operation Cooling Efficiency ^a Air Source EER (FL/PLV), Btu/W·h Water Source Power Input per Capacity (FL/PLV), kW/ton _s		Heating Operation		Heat-Pump Heating Full-Load Efficiency (COP _{HP}) ^b , WW				Heat Recovery Chiller Full-Load Efficiency (COP _{HC}) ^b , WW			
		Path A	Path B	Heating Source Conditions (entering/leaving water) or OAT (db/wb), °F	Leaving Heating Water Temperature				Leaving Heating Water Temperature				
					Low	Medium	High	Boost	Low	Medium	High	Boost	
Air source	All sizes	≥9.595 FL ≥13.02 IPLV,IP	≥9.215 FL ≥15.01 IPLV,IP	47 db 43 wb ^d	≥3.290	≥2.770	≥2.310	NA	NA	NA	NA	NA	NA
		≥9.595 FL ≥13.30 IPLV,IP	≥9.215 FL ≥15.30 IPLV,IP	17 db 15 wb ^d	≥2.230	≥1.950	≥1.630	NA	NA	NA	NA	NA	NA



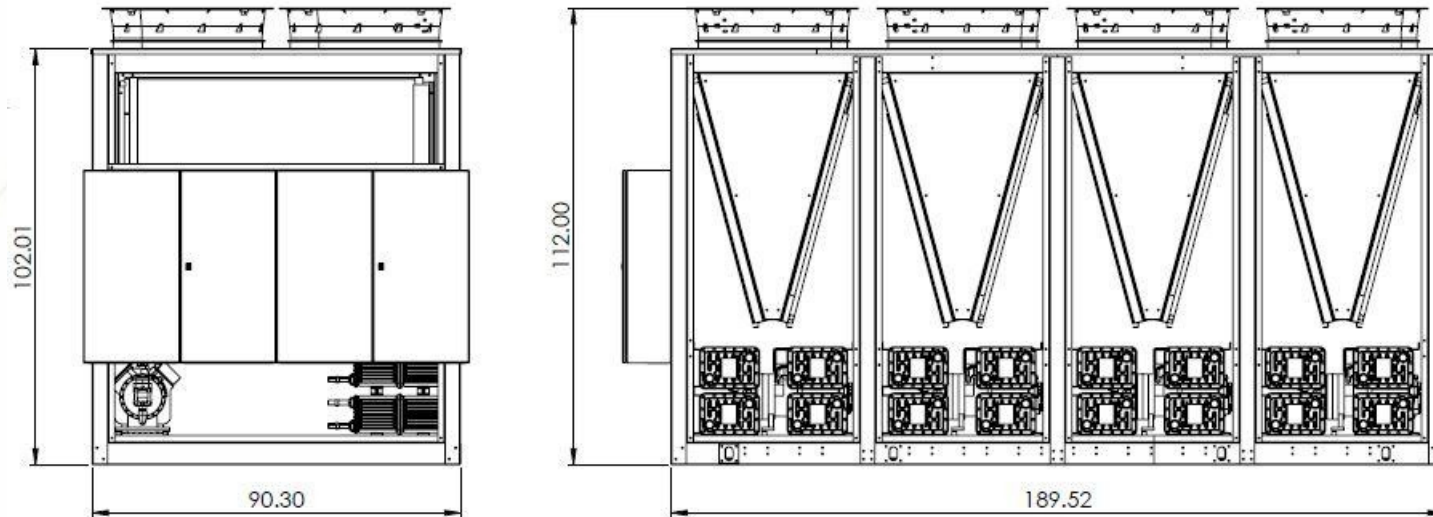
Our reciprocating model

Each circuit has its own independent controls for first-class redundancy.



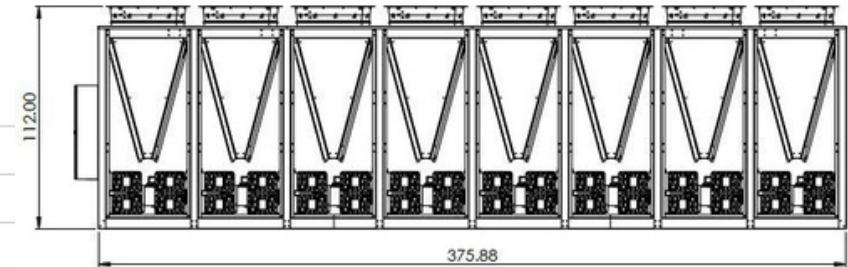
4-pipe simultaneous heat pump

Ranges in sizes from 25 tons to 200 tons on the same platform as the 2-tube reciprocating. Since all modules are driven by VFDs and have their own controller, this results in best-in-class reliability and precision control.



Here is a look at our size 200 and typical operating conditions to illustrate performance

in heating-	25F ambient making 110F water	133.6tons
in cooling-	95F ambient making 45F water	196.0tons
simultaneous mode-	making 110F hot water & 45F cold water	255.2tons heating + 188.8tons cooling



in simultaneous mode we are pulling the heat from the cooling water loop and pushing it into the heating water loop

At the conditions above (45/110) this represents a TER of 6.93

TER is total energy recovery, and it is in the same units as COP

said another way, you put 1.0kw of electricity into this unit at these conditions and you get 7x the input in productive output

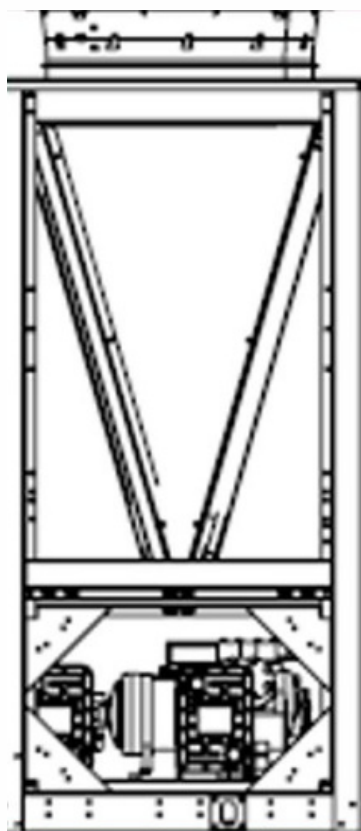


Renewable connectivity: a great option!

On a 23°F ambient day we can make 190 MBH of 110°F water at a COP of 2.2 with our size 025, it consumes 25.2kw of power....
And with some renewable energy sources (shown below) we will only need to consume 1.2kW of utility power



25.2kw
input



12kw from 30 PV panels



12kw from 5
Solar Thermal





The status of Ecogreen:

2-tube ASHP product- **Available today!**

4-tube ASHP product- **Available today!**

Dedicated heat recovery **Available today!**

4-pipe water-to-water heat pump, and 6-pipe simultaneous water-to-water heat pump...

available today!

Ecogreen®

Ecogreen® Heat Pumps & Heat Recovery Chillers



- ✓ Chillers with Heat Recovery
- ✓ 2 Pipes, 4 Pipes, 6 Pipes
- ✓ Free Cooling
- ✓ Pre Cooling
- ✓ Air Source Heat Pumps
- ✓ Water Source Heat Pumps
- ✓ Simultaneous Operation

Next Gen Refrigerants Now!

Low GWP Refrigerants		
R-513A	R-32	R-454B
GWP 573	GWP 677	GWP 467
A1	A2L	A2L

❄️ EER 18 🔥 COP up to 5 🌞 TER up to 9

Reliable:

- Low Ambient Operation
- High Lift Applications
- Heat Recovery Applications

Fully Serviceable:

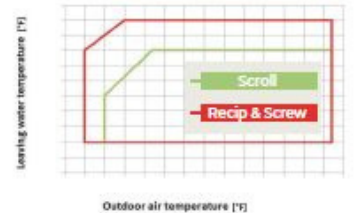
- Shell Box Coils
- Reciprocating
- Screw Compressors

Custom Solutions:

- Pumps
- Tanks
- Domestic Hot Water

Renewable Connectivity:

- Photovoltaic
- Wind
- Solarthermal



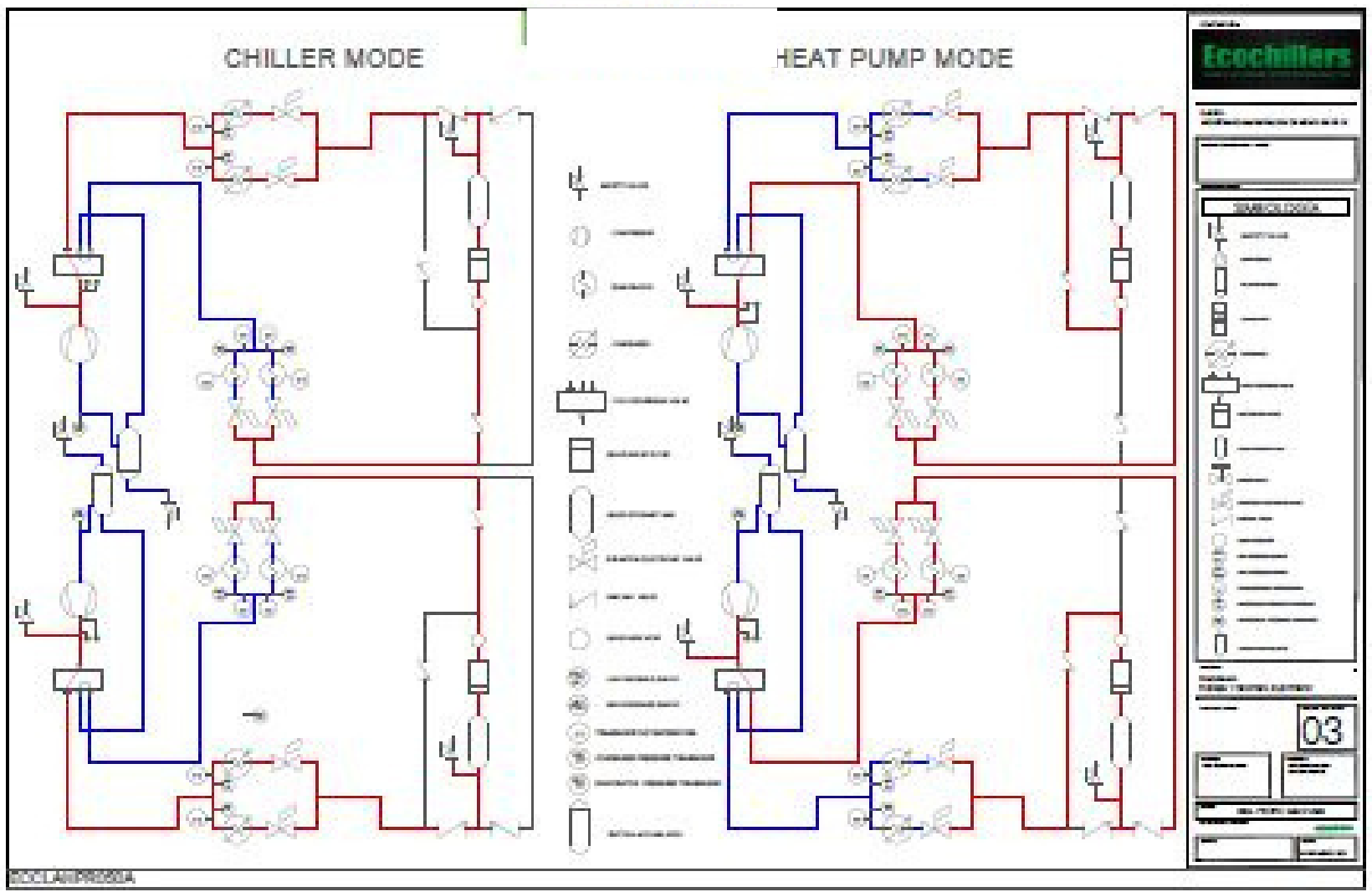
🌐 www.ecogreenheatpump.com
 ✉️ ecogreen@airreps.com
 ☎️ 425 985 8354

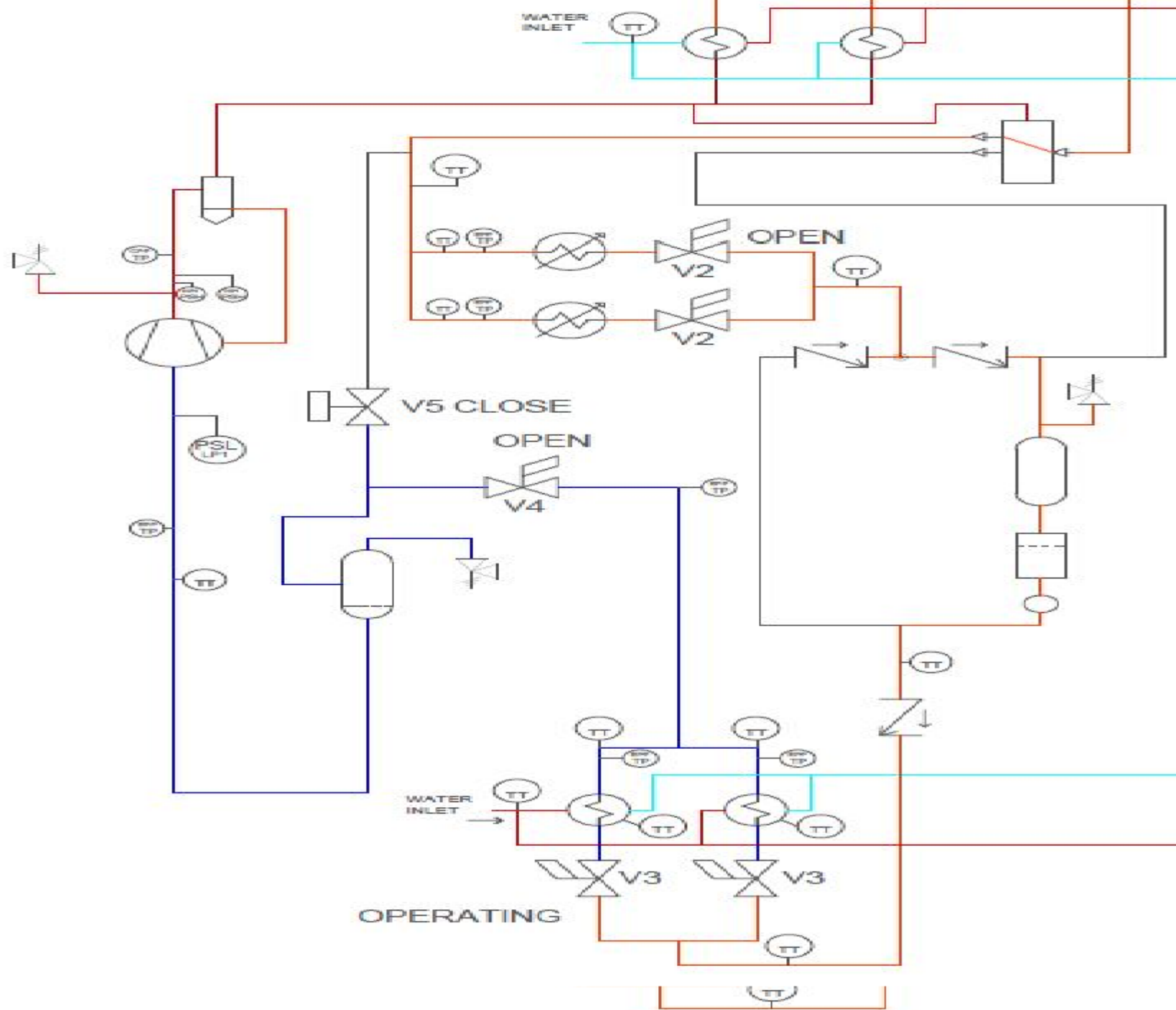
INVERTER

towards
NET ZERO

Ecogreen®

Heat Pumps & Heat Recovery





While the competition tries to catch the charge, we track the charge with each circuit!

Each circuit is balanced (modulated) to satisfy all loads.

We heat and cool to the correct capacity AT THE SAME TIME!

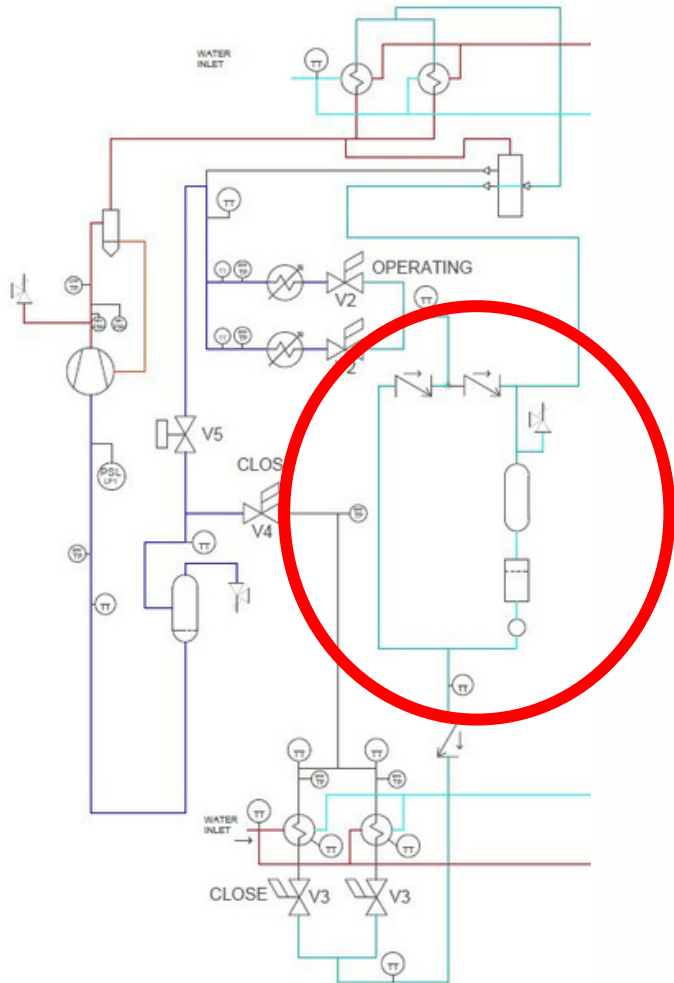
The others turn on/off and bounce from one mode to another using time and loop temperature drift in an effort to catch charge. . .

But it's reactive rather than proactive.

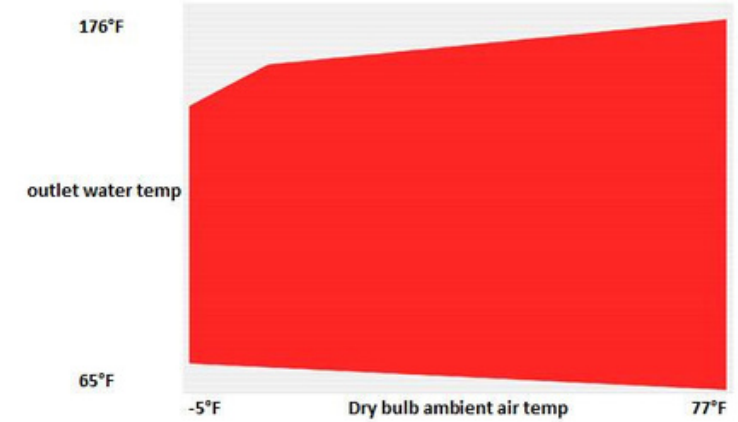


Industry Leading Reliability

Proper Application of Compressor Operation Map



receivers
refrigerant for
mismatched charges
refrigeration and
heating



VFD on compressors and EC
motors on air coil fans



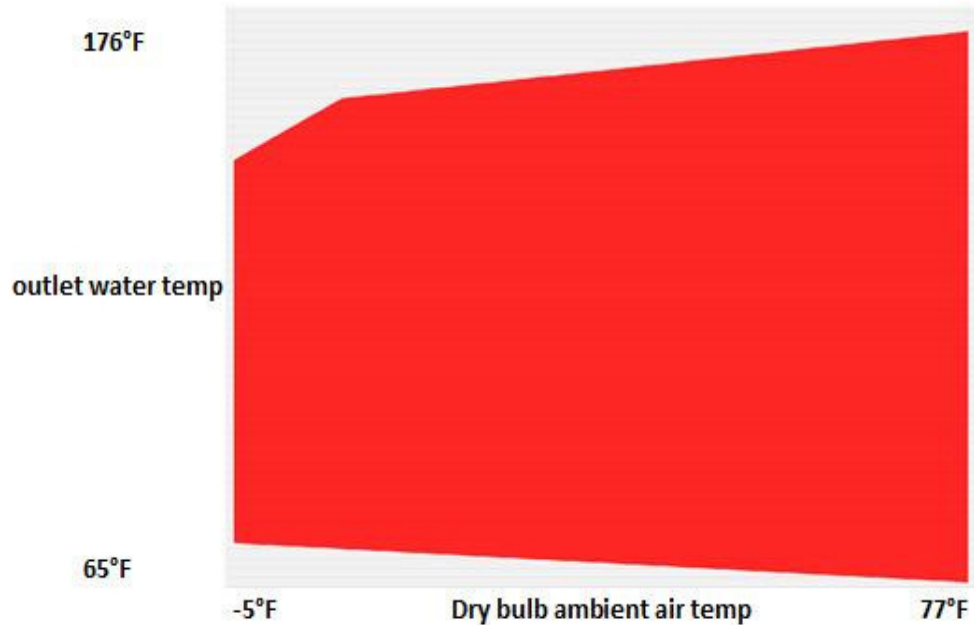
High lift (hot water) and low suction (cold environment) conditions in heating mode are very similar to commercial refrigeration.

Just the opposite!





Proper Application of Compressor Operation Map



Proper Application of Compressor Operation Map



Compressors semi-hermetic designed for high ambient temperatures and elevation

Deeper dive

Fully repairable

Semi-hermetic compressors are designed to be worked on site



Shell-box heat exchanger can be opened and cleaned





Customizable



Medium

Ecogreen[®] Heat Pumps & Heat Recovery Chillers

November 24, 2022

Air-source Heat Pump Braze Plate
Inverter Performance



Unit Tag	Qty.	Model Name	Frame Size	Volts/Ph/Hz	Refrigerant
ECC	1	ECCLAHPS184A	184	460/3/60	R-32

Hot Fluid Flow Data		Ambient Conditions		Heating Performance Data	
Entering fluid temp °F	70 °F	Ambient temp °F	15 °F	Heating capacity MBH	1,358.71
Leaving fluid temp °F	90.5 °F	Altitude ft.	4783 ft	COP Heating	2.19
Flow rate gpm	148.11 gpm	Min. operating Temp °F	10 °F		
Fluid 40%	Propylene Glyco	Max. operating Temp °F	120 °F		
Fluid pressure drop	3.0 ft H2O				
Fouling factor	0.0001 h-ft ² ·°F/Btu				
				Physical Data	
				Rigging Wt. lbs.	
				Operating Wt. lbs.	

Electrical Data	Circuit 1	Circuit 2	Circuit 3
Compressor type	Scroll 30hp	Scroll 30hp	Scroll 30hp
Compressor quantity	3	3	2
Per compressor Amps	30.90	30.90	30.90
Compressor RLA	48.36	48.36	48.36
Compressor LRA	280.7	281	280.70
Per compressor kW	20.43	20.43	20.43
Condenser quantity	3	3	2
Heat rejection Btu/h	509,517	509,517	339,678
Coil type	DXK03C11.5-62.00X63C11.5-62.00X63C11.5-62.00X6		
Fan type	EF900	EF900	EF900
Fan quantity	3	3	2
Per fan FLA	4.60	4.60	4.60
Per fan kW	2.28	2.28	2.28

Single Point	
Minimum Current Ampacity	376.83
Maximum Over-Current Protection	380 A

Operating Condition Electrical Data			
Compressor kW	163.46	Total Amps	284.01 A
Total fan kW	18.27	Starter type	Compressor VFD
Total kW	181.73		ECM Fans

*Nominal capacity according to AHRI 550/590

NOTE: the Chiller's cooling capacity and its heat generation are affected by the operating conditions, the heat recovery performance varies depending on the thermal load and chiller operation.

EDCP V5.8

MECHANICAL SPECIFICATION:

AIR TO WATER HEAT PUMP

PART 1 - GENERAL

1.1 SUMMARY

- A. Section Includes: Packaged, air-source/sink, electric-motor-driven, compressorized, water Heat Pump.

1.2 SUBMITTALS

- A. Product Data: Include refrigerant, rated capacities, operating characteristics, furnished specialties, and accessories.
- B. Certification: TÜV SÜD America or nationally recognized test lab certification. Performance in accordance with the AHRI 550/590 & ASHRAE standard 90.1 2019

PART 2 - PRODUCTS

2.1 PACKAGED AIR TO WATER HEAT PUMP

- A. Description: Factory-assembled water heat pump complete with base and frame, outdoor coil casing, compressors, compressor motors, and motor vfd's, water-to-refrigerant heat exchangers, air-to-refrigerant coils, air coil fans with ec motors, electrical power panel, renewable connectivity components, unit controller & bms interface, and accessories.
- B. Cabinet:
 1. Base: Painted heavy gauge steel base extending the perimeter of heat pump.
 2. Frame: Rigid Painted Steel frame secured to base and designed to support all components not directly supported from base.
 3. Casing: Painted Steel.
 4. Finish: Coat base, frame, and casing with rustproof polyester paint, optionally color matched for architectural considerations
- C. Compressors:
 1. Description: Positive-displacement semi-hermetic reciprocating (screw) type for field serviceability.
 2. Each compressor provided with crankcase oil heater, suction line accumulators, and oil separator circuits.
 3. Capacity Control: through variable frequency drives
 4. Oil Lubrication System: Automatic externally serviceable oil pump on Screw and Reciprocating compressors with strainer, sight glass, filling connection, filter with magnetic plug, and initial oil charge on all applications.

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Heat Pumps & Heat Recovery



IMAGE OF THE AIR SOURCE HEAT PUMP
SIZE 50 MODEL ECCLAHPR050

confidential- do not distribute

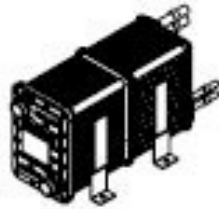
ASHP 100 TON COOLING/HEATING

Weight : 9630 pounds
Weight Loaded: 10,371 pounds

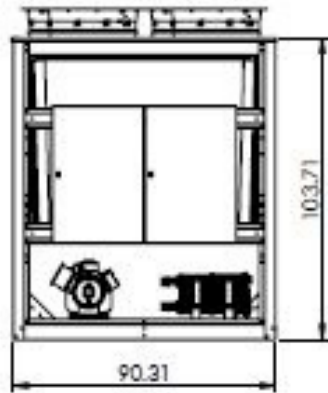
Recip Technology



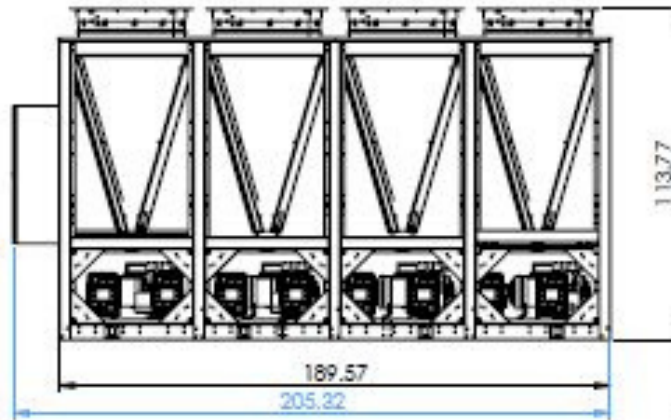
Shellbox



Isometric View



Front View

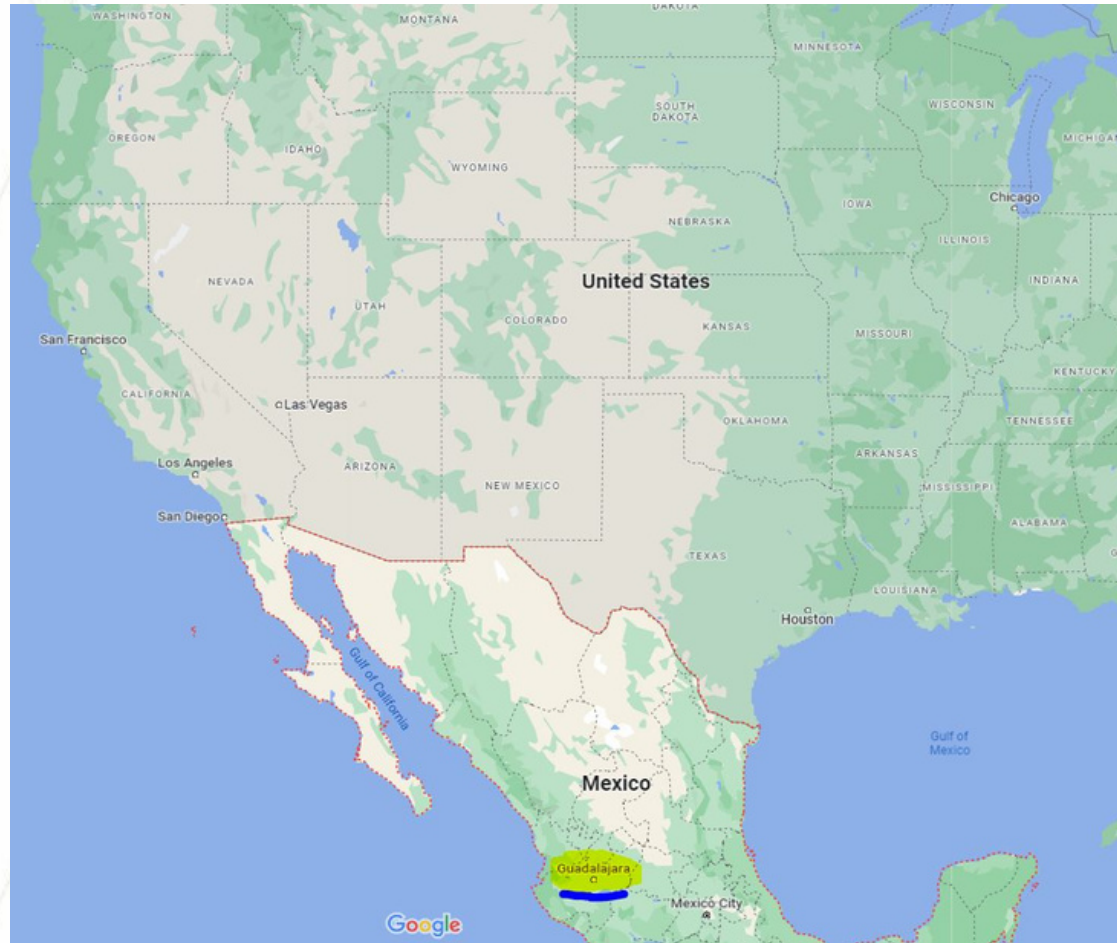


Right View

Unit: inches	Unit: mm
Ecochillers	
Date:	Unit: mm
Color:	Unit: mm
Design: Aaron Chavath	Part: ASHP 100 TON
Scale: 1:1	Sheet: A3
Height:	Sheet: 1



About Ecochillers

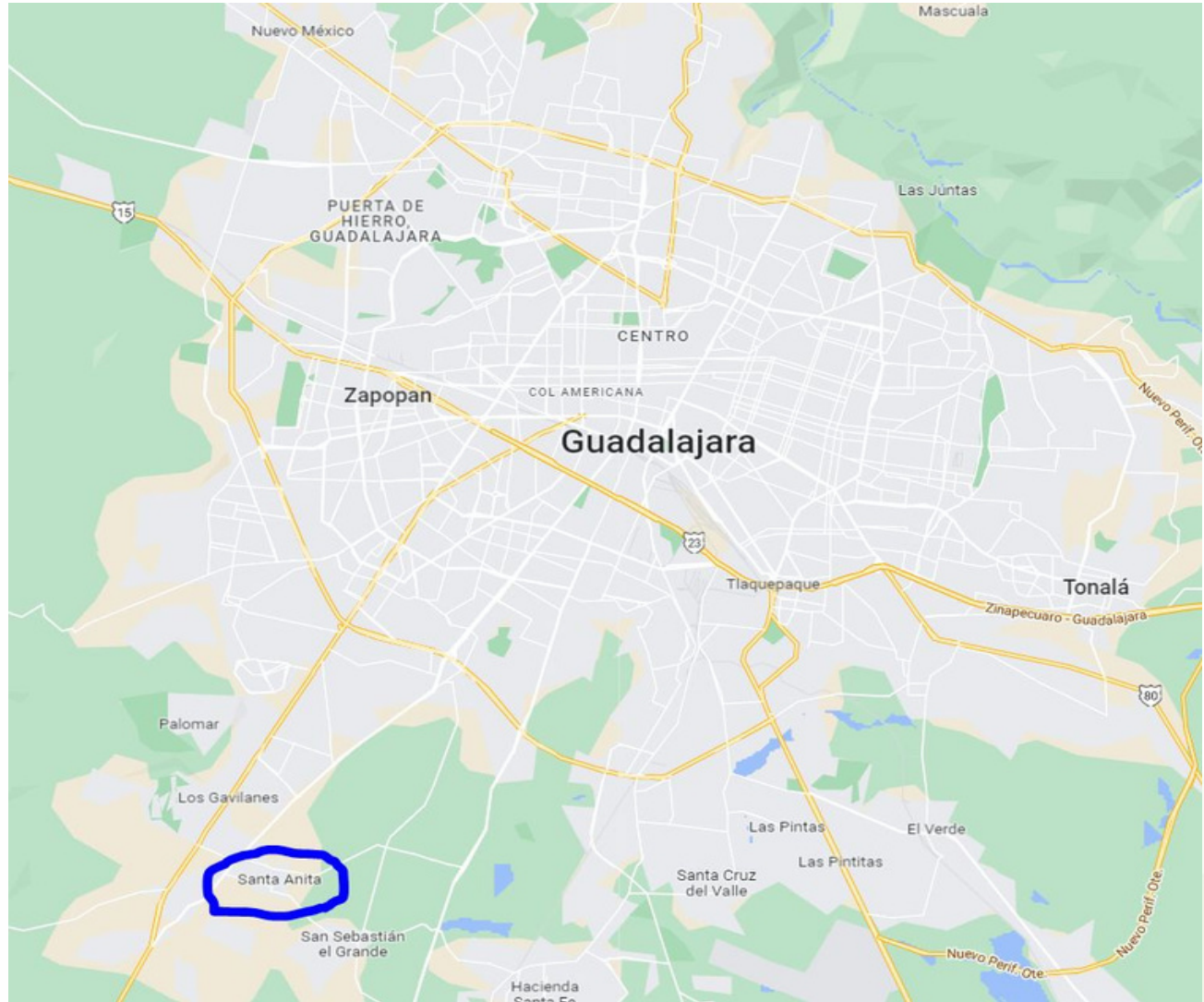


Ecochillers is a Mexican manufacturer of chillers, and they specialize in heat recovery.

In business for 25 years they are located in Guadalajara, Mexico, just northwest of Mexico City.

Ecogreen heat pumps are another chapter in a long history of EcoChiller production.

Guadalajara



○ Guadalajara, where old meets new





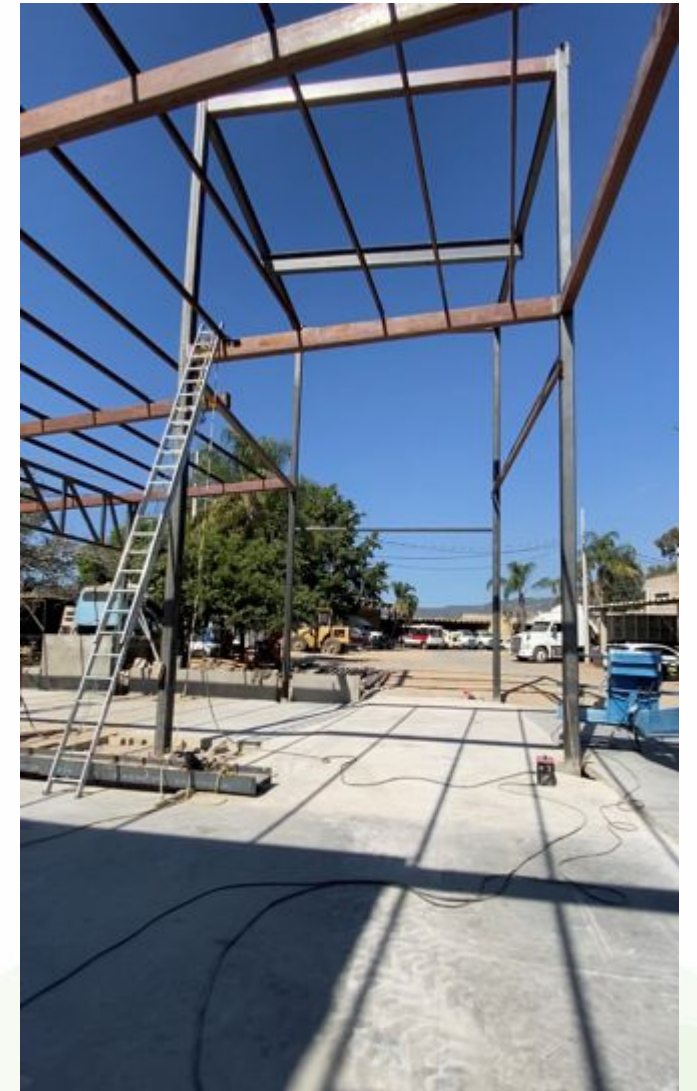
Meet Pedro and the Ecochillers team








We are
Growing
fast!



Ecogreen[®]
Heat Pumps & Heat Recovery





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Q&A