GAS ENGINE HEAT PUMPS

Heating, Cooling and hot sanitary water from an efficient, renewable and sustainable technology

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AISIN GAS ENGINE HEAT PUMP
Technology

TOTAL ENERGY SYSTEM

GAS ENGINE HEAT PUMP

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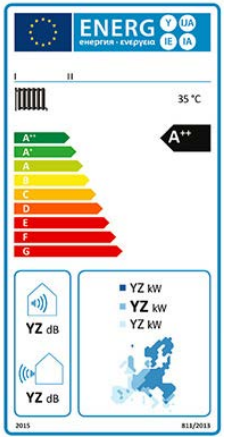
GAS ENGINE HEAT PUMP

A new heat pump...

... with **high annual energy efficiency**, optimized both for the winter and summer season



A++

... with **high energy performance** at standard rated conditions

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A new heat pump...

... that produces **renewable heat**

... to be considered as **Total Energy System**: the residual heat is completely recovered

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GAS ENGINE HEAT PUMP

A new heat pump...

... **sustainable,** with zero emissions of PM 10 and a production of low-carbon heating & cooling energy

... **quality,** a solution at the new national and european efficiency strict limits

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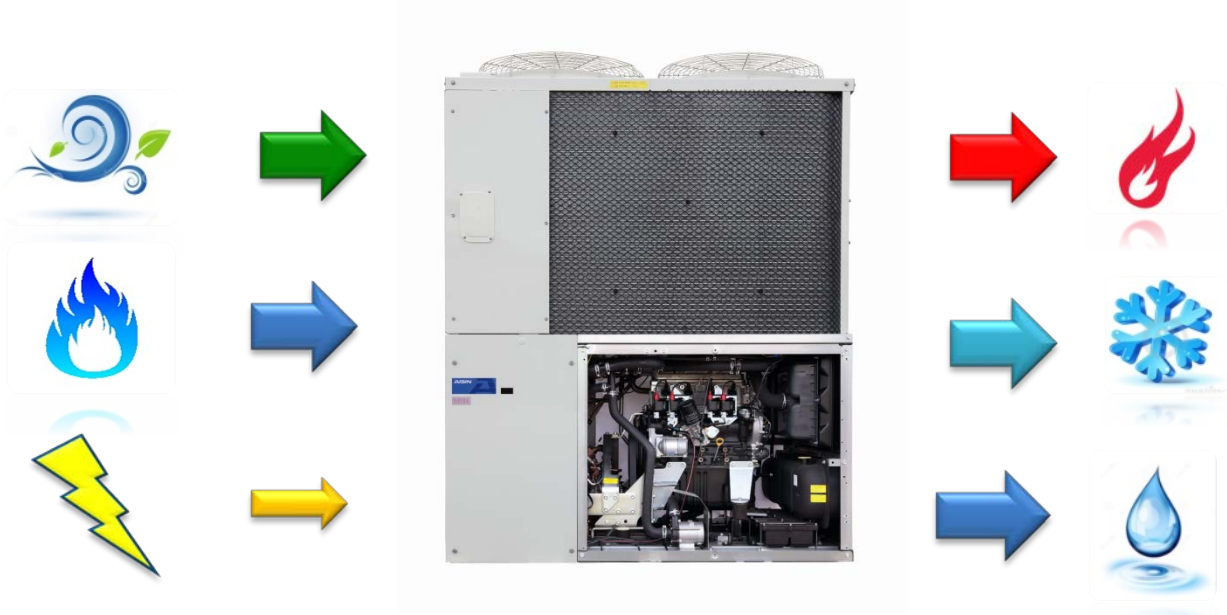
GAS ENGINE HEAT PUMP

How it works

The Gas Heat Pump (GHP) is a compression heat pump driven by a gas combustion engine

GHP uses the renewable energy of air + primary energy (NG or LPG gas) to provide heating, cooling and domestic hot water.

INPUT



OUTPUT

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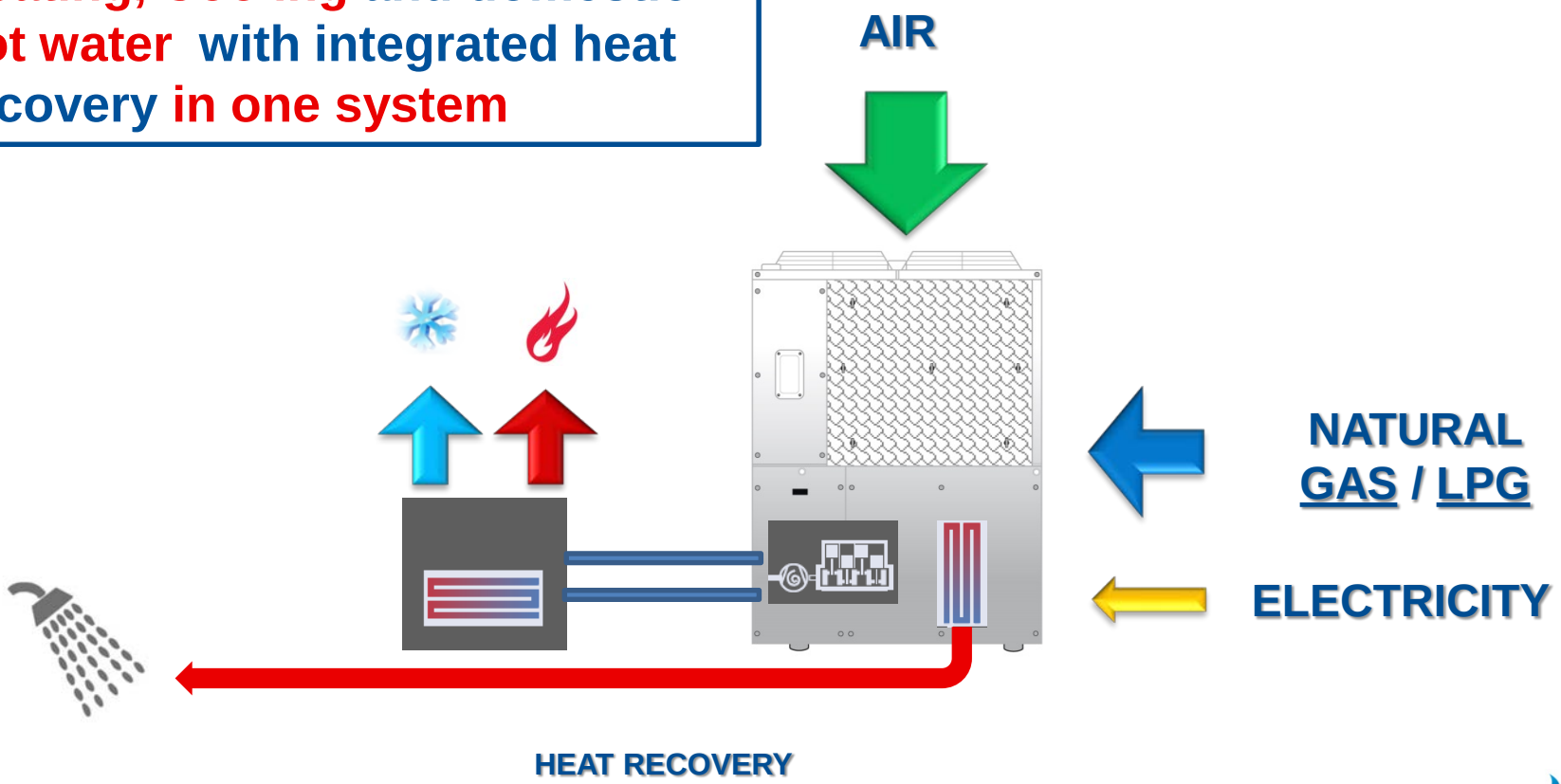
GAS ENGINE HEAT PUMP

Integrated solution

Heating, Cooling and domestic hot water with integrated heat recovery in one system



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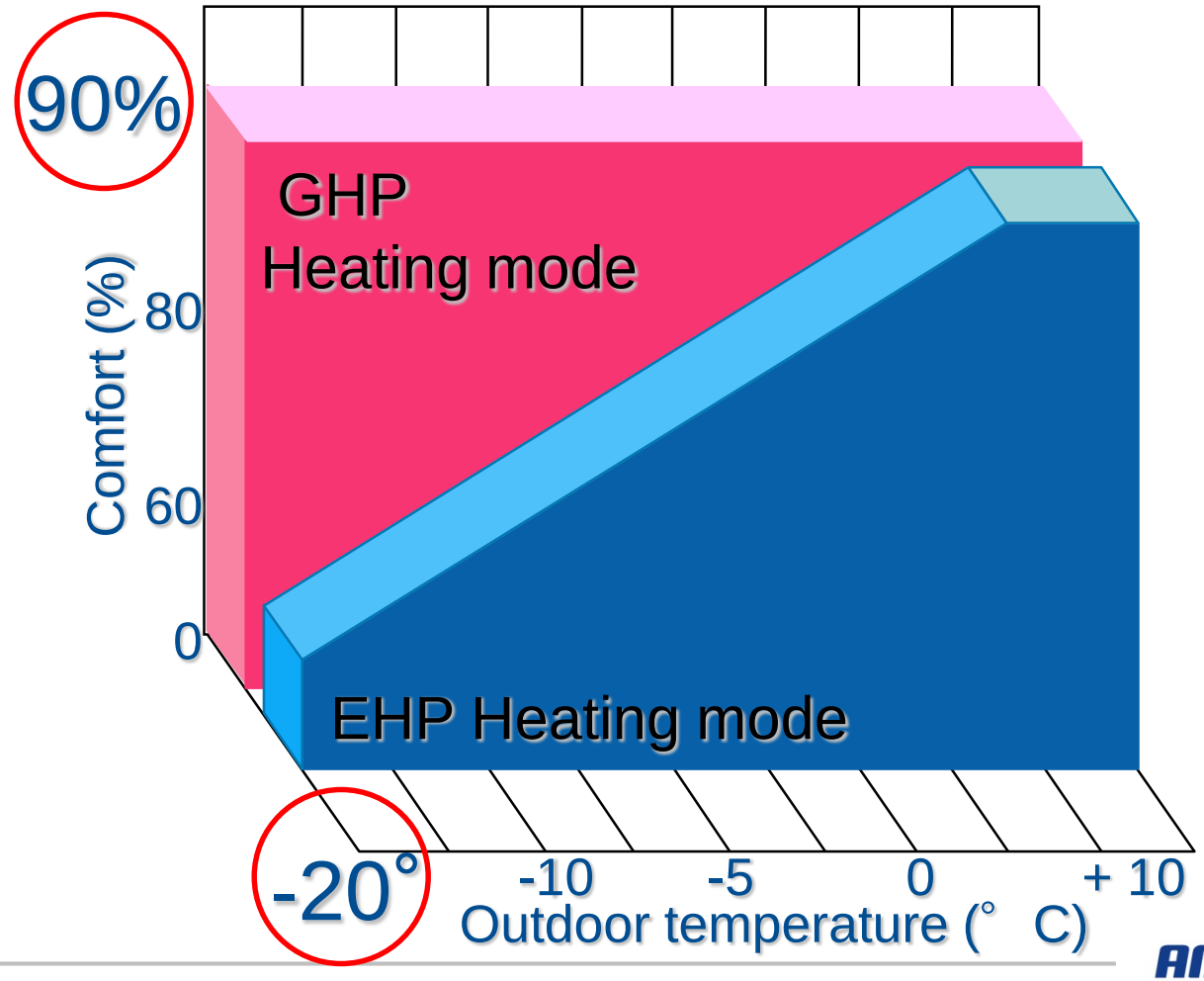
GAS ENGINE HEAT PUMPS

Heat recovery

CONSTANT HEATING CAPACITY AT LOW TEMPERATURES



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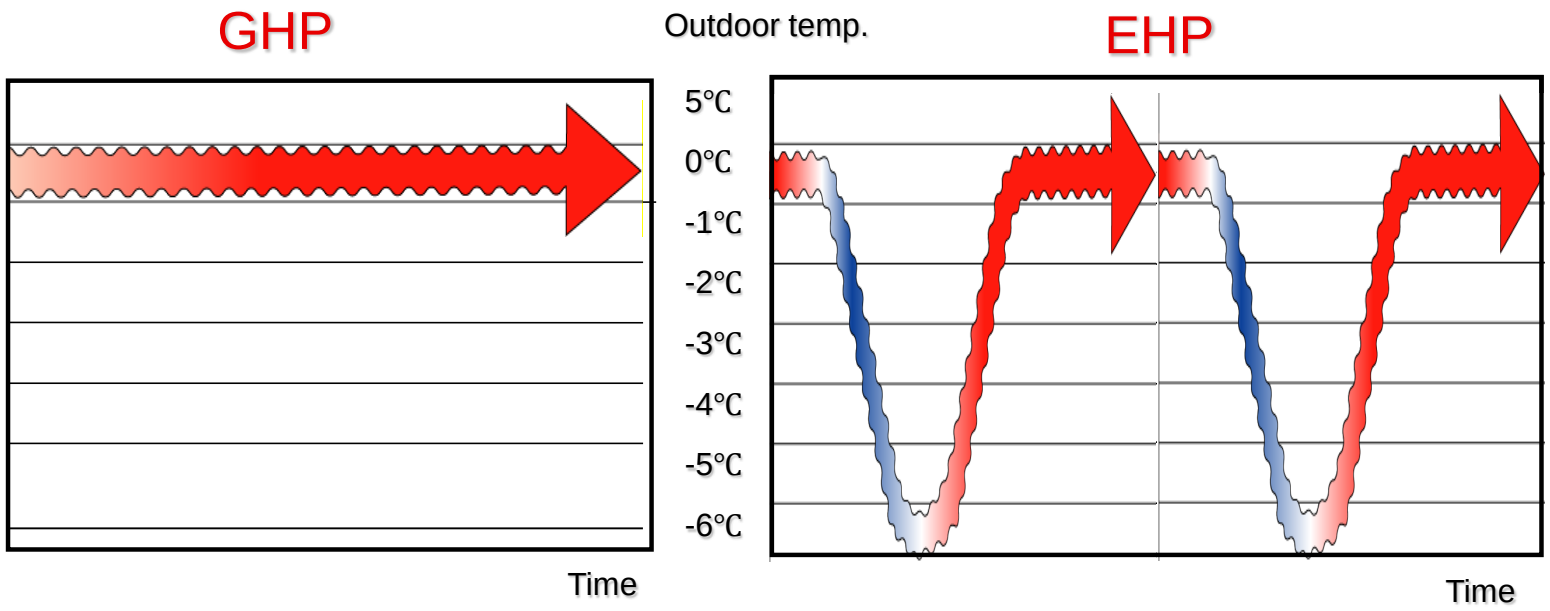
GAS ENGINE HEAT PUMPS

Heat recovery

REDUCED NUMBER OF DEFROST CYCLES



Defrost may occur in case of strong humidity area

Reduced comfort because of the cycle inversion

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GAS ENGINE HEAT PUMPS

Product line up

8-10-13 HP

22,4-28-35,5kW cooling

16-20-25-30 HP

45-63-71-85 kW cooling
Combination Multi: up to 170 kW

Direct expansion or Air-to-water system

Combination multi system

Free Domestic Hot Water production

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GEHP

Small sizes - performances

	8 HP	10 HP	13 HP
Cooling capacity	22,4 kW	28 kW	35,5 kW
Heating capacity	25 kW	31,5 kW	40 kW
Fuel consumption	15 – 15,9 kW (1,59 – 1,68 m³/h)	19,2 – 20,3 kW (2,03 – 2,15 m3/h)	26,4 – 27 kW (2,79 – 2,86 m³/h)
GUE cooling*	1,49	1,46	1,34
GUE heating*	1,57	1,55	1,48
W-kit recovery	8 kW	10 kW	13,5 kW
GUE cool. + W-Kit*	1,99	1,96	1,84
GUE heat. + W-Kit*	1,82	1,80	1,73

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GEHP

Big sizes - performances

	16 HP	20 HP
Cooling capacity	45 kW	56 kW
Heating capacity	50 kW	63 kW
Fuel consumption	31,4 – 29,8 kW (3,32 – 3,15 m3/h)	38,9 – 38,1 kW (4,11 – 4,03 m3/h)
GUE cooling*	1,43	1,44
GUE heating*	1,68	1,66
W-kit recovery	15,7 kW	19,5 kW
PER cooling*	1,93	1,76
PER heating*	1,83	1,94

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GEHP

Big sizes - performances

	25 HP	30HP
Cooling capacity	71 kW	85 kW
Heating capacity	80 kW	95 kW
Fuel consumption	54,4 –53,9 kW (5,76 – 5,70 m3/h)	71,2 – 69,4kW (7,53 – 7,34 m3/h)
GUE cooling*	1,31	1,19
GUE heating*	1,49	1,37
W-kit recovery	27,2 kW	35,6 kW
PER cooling*	1,81	1,69
PER heating*	1,64	1,52

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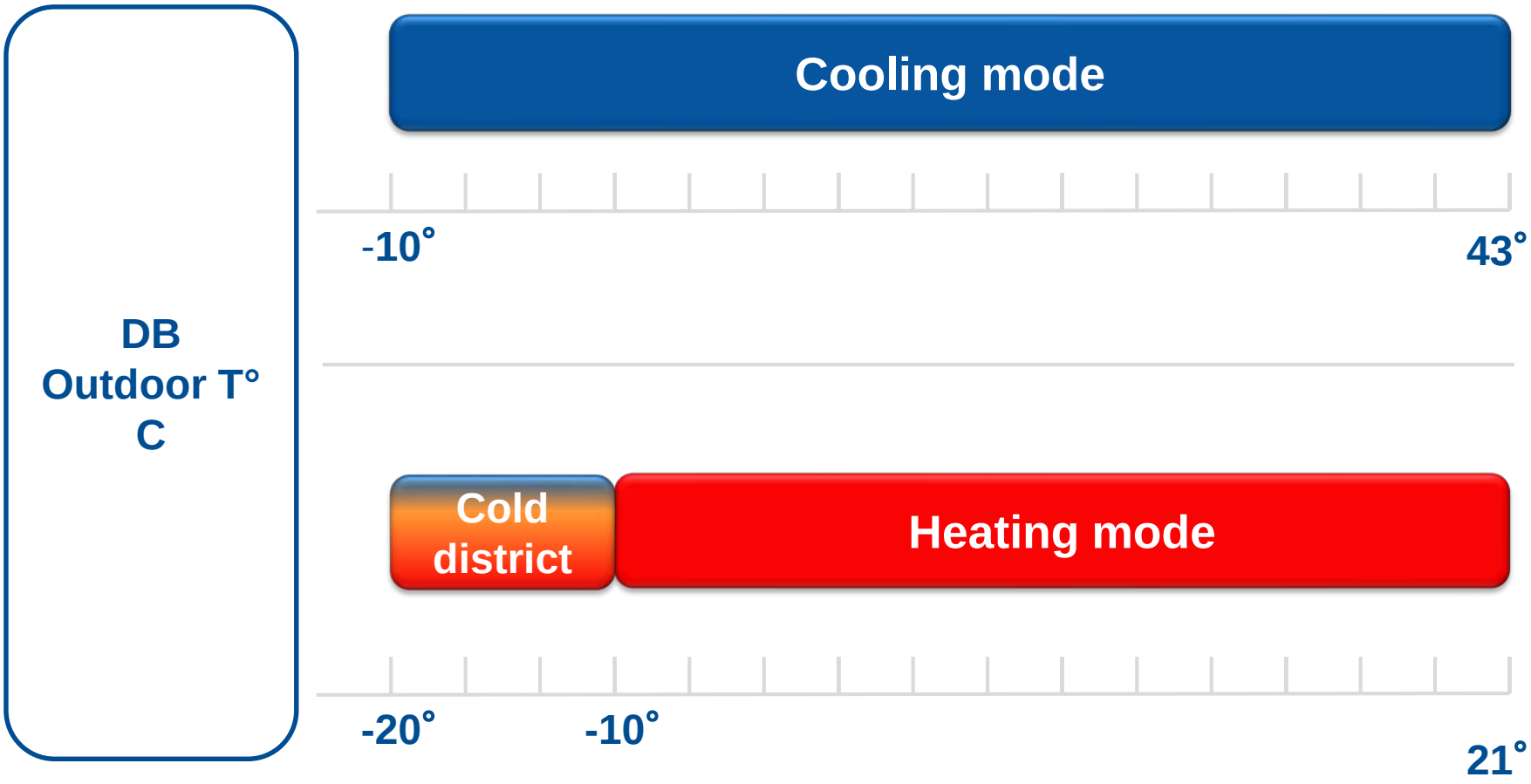
Outdoor temperature operation range



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GEHP

Direct expansion layout

LAYOUT EXAMPLE

VRV/VRF system type

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GEHP
Indoor units line up

4-way cassette
60 x 60

4-way round flow cassette

Ceiling suspended

Slim concealed ceiling unit

2-way cassette

1-way cassette

Wall mounted

Standard duct type

Floor standing

VAM

VKM

Hotel duct type

High static pressure duct type

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GEHP
Controllers

Standard wired controller

Infrared wireless controller

I-Touch Manager

Wall built-in controller

Wall built-in simplified controller

Standard central controller

I-Touch Controller

Central ON/OFF controller

Weekly Timer

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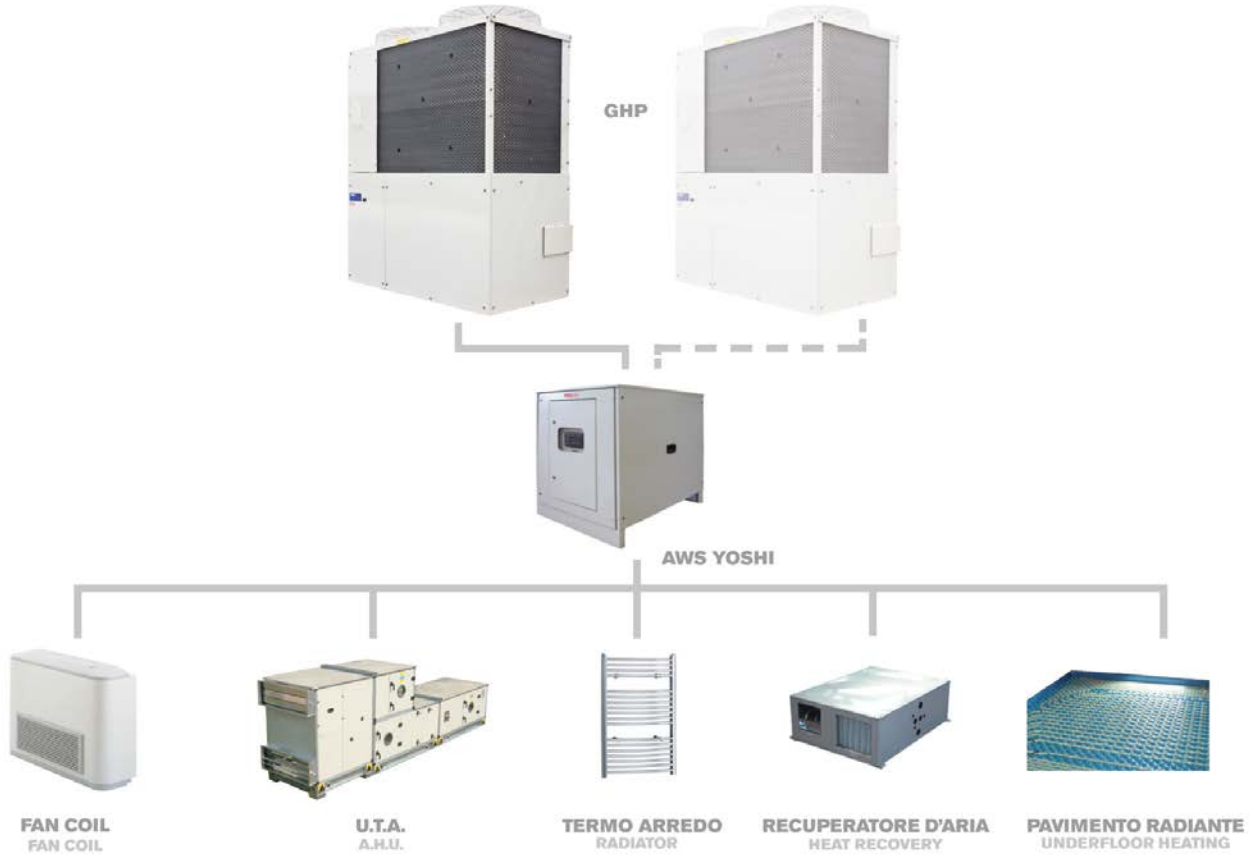
GEHP

«Combination Multi» AWS Twin



LAYOUT EXAMPLE

Air-to-Water distribution

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GEHP

Air to water layout: Yoshi AWS features

AWS is a sofisticated heat exchanger AIR to WATER:

- Modulating refrigerant capacity according to building demand through the return water T° on the primary circuit.
- Built-in pump control (only for single AWS)
- Built-in antifreeze protection, flow and pressure switches
- Built-in timer
- Electronic expansion valve

CONSTANT WATER FLOW RATE

AWS TWIN:

- Same single AWS settings and dimensions
- One device can provide up to 150 kW heating - 126 kW cooling
- Reduced installation spaces and costs
- Only for GHP big sizes combi (16-20-25-30 HP)

GEHP

Air to water layout: Yoshi AWS features

ANALOGUE INPUTS:

- setpoint T° regulation with 4-20mA signal
- capacity management with 4-20mA signal

AWS F model improved **included** connectivity:

- Gateway ModBus RTU
- Gateway ModBus IP
- Data Logger with WEB access
- **WebServer –** Each AWS system components can be controlled and managed by remote.

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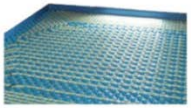
W-kit: free Domestic Hot Water

GHP



PAVIMENTO RADIANTE
UNDERFLOOR HEATING

U.T.A.
A.H.U.

WKIT ensures high performances at different loads

The heat is fully recovered (only for gas engine driven heat pumps)

The recovered heat can be used for:

Free domestic hot water

Buildings heating

Air Handling Unit post-heating

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GEHP

Hot sanitary water production

	Water flow – lt/minute				
	IN/OUT (T°C)				
	55/60	50/60	40/60	30/60	25/60
WKIT - 8HP	23	11,5	5,8	3,8	3,3
WKIT - 10HP	28,7	14,4	7,2	4,8	4,1
WKIT - 13HP	38,8	19,4	9,7	6,5	5,5
WKIT - 16HP	47,4	23,7	11,8	7,9	6,8
WKIT - 20HP	57,5	28,7	14,4	9,6	8,2
WKIT - 25HP	71,8	35,9	18,0	12,0	10,3
WKIT – 30 HP	119,3	59,6	29,8	19,9	17

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GEHP F – MODEL

is introduced to comply with the European ECO DESIGN Directive

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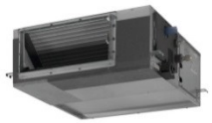
GEHP F – MODEL
Line-up

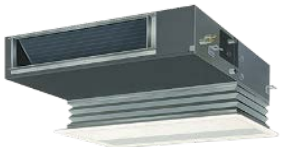





DX Systems

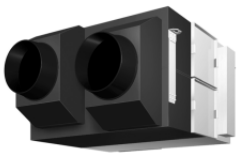




Up to 63 connectable indoor units

Up to 160% connected capacity

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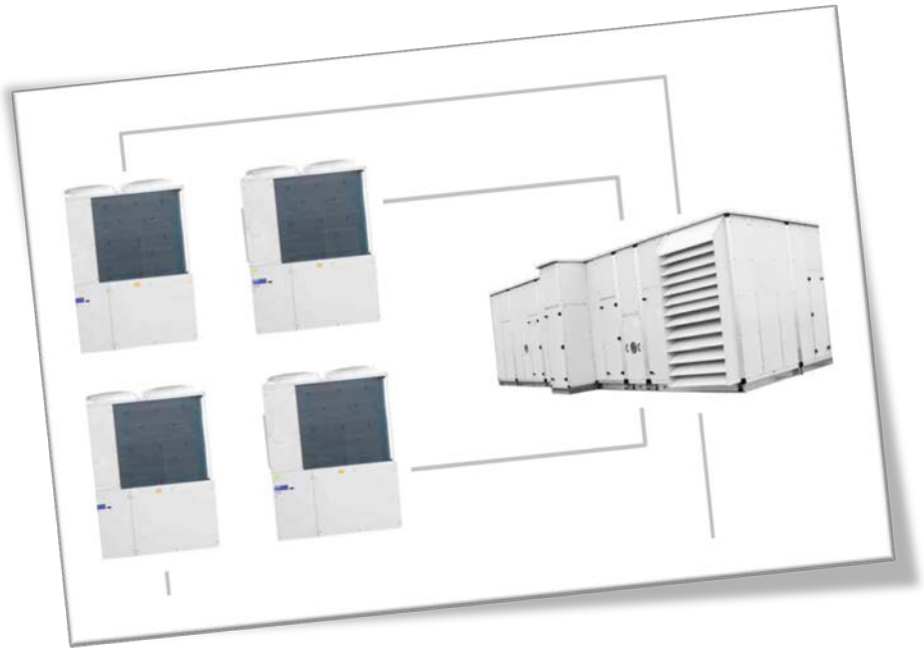
GEHP F – MODEL

Line-up



AHU systems

Model	EASY13	EASY30	EASY60	EASY90	EASY120
Cooling (kW)	↑33,5	↑85	↑2X85	↑3X85	↑4X85
Heating (kW)	↑40	↑97,4	↑2X97,4	↑2X97,4	↑2X97,4
Circuits number	1	1	2	3	4

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GEHP F – MODEL

Line-up

Air-water systems

Model	8HP	10HP	13HP	16HP	20HP	25HP	30HP	40HP	50HP	60HP
Cooling (kW)	21,0	26,5	33,5	42,5	53,0	63,5	74,5	↑106	↑127	149
Heating (kW)	23,5	30,0	37,5	50,0	62,5	77,0	87,5	↑125	↑154	175
Recovery (kW)	8,0	10,0	13,5	19,5	23,5	30,5	44,5	↑47	↑61	89

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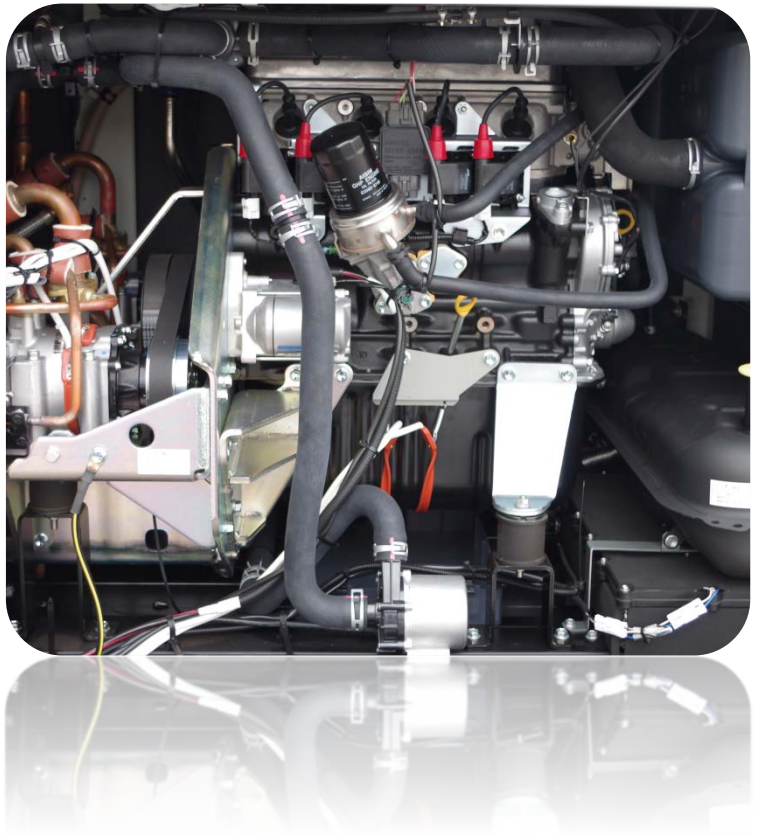
GEHP F – MODEL

What's new

- 30 HP Outdoor unit
- Variable capacity scroll compressors
- New refrigerant circuit
- Environment protection features
- Management solutions tuned on the installation needs



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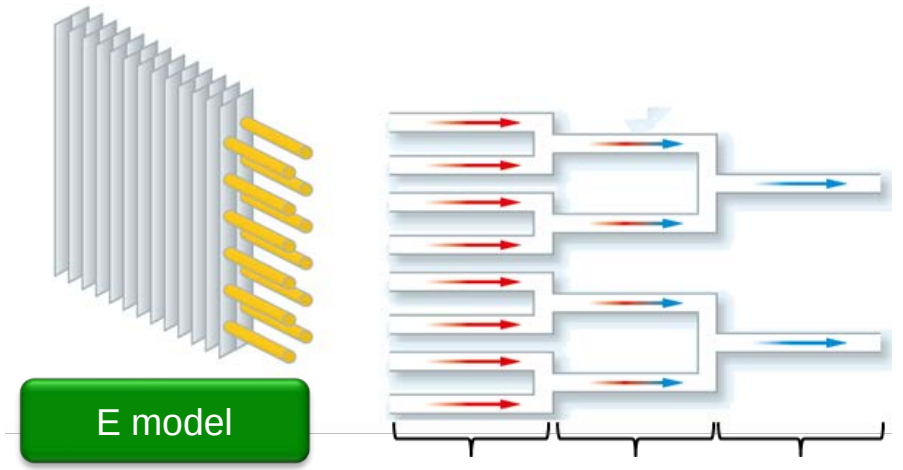
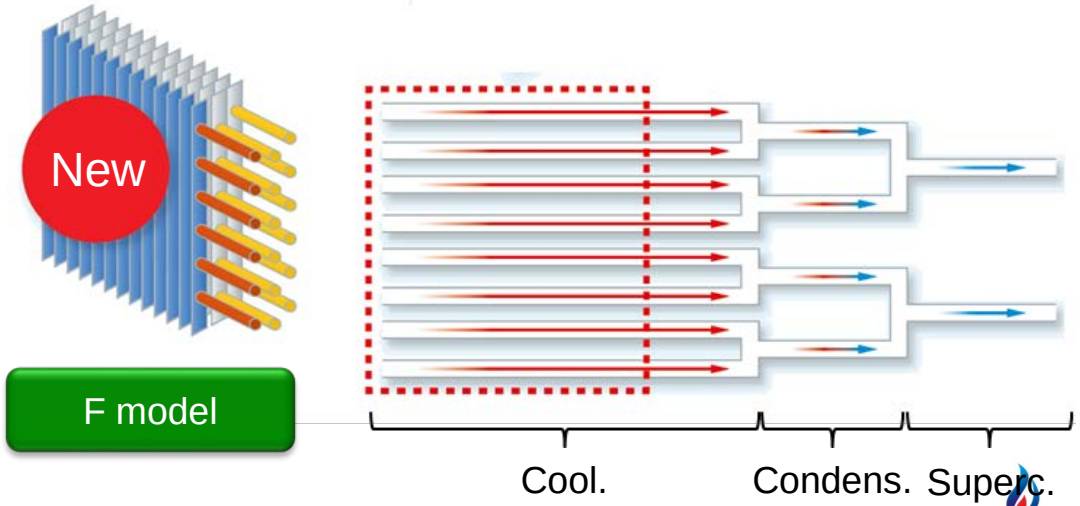
GEHP F – MODEL
What's new

Outdoor unit heat exchanger

- 60% bigger heat transfer surface
- Increased hight and one added row
- Engine radiator increased size





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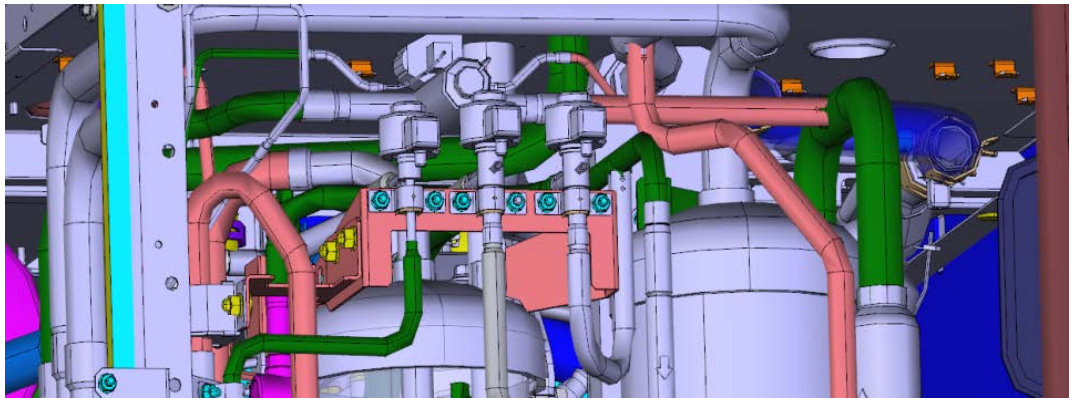
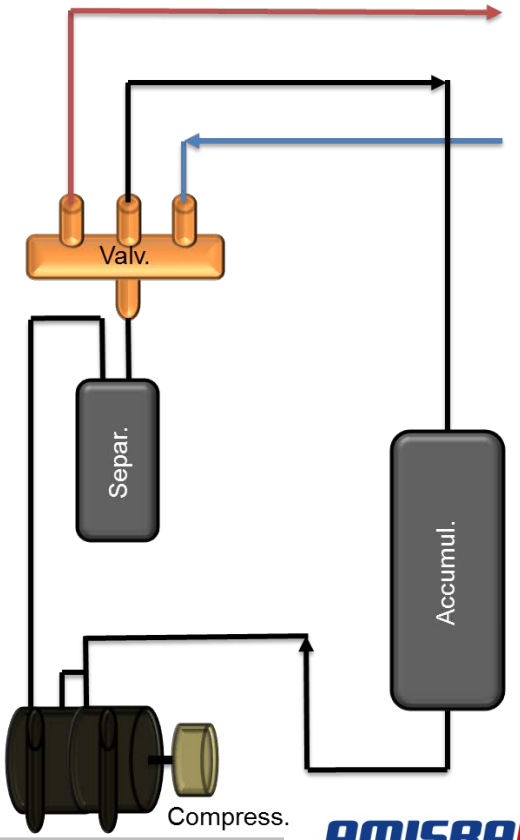
GEHP F – MODEL

What's new



4-way bypass



- Less pressure drop in cooling
- Improved layout of components
- Higher overall efficiency

E model

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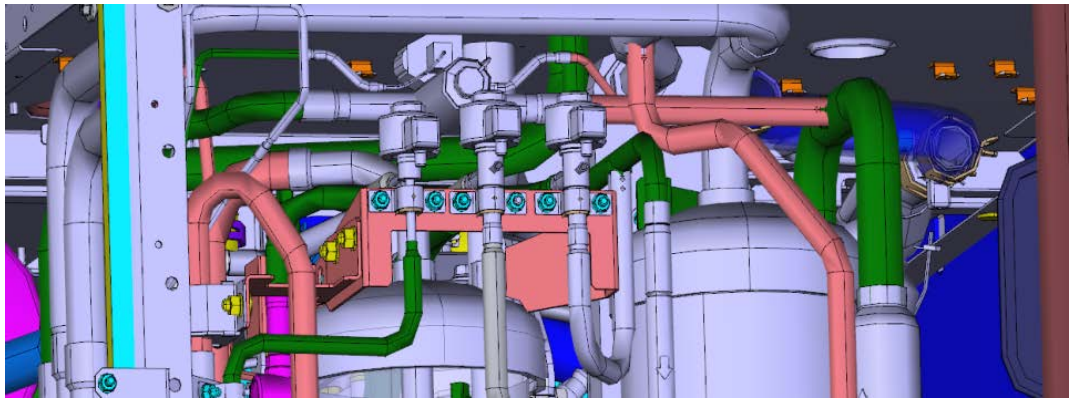
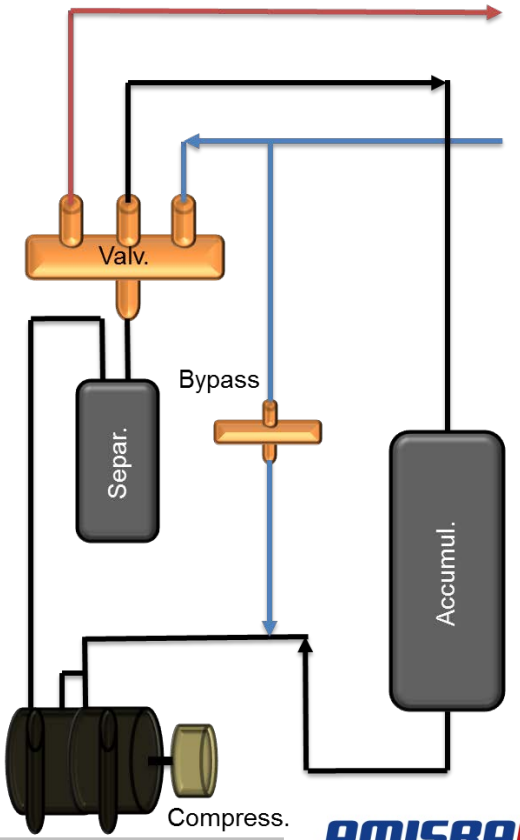
GEHP F – MODEL

What's new



4-way bypass



- Less pressure drop in cooling
- Improved layout of components
- Higher overall efficiency

F model

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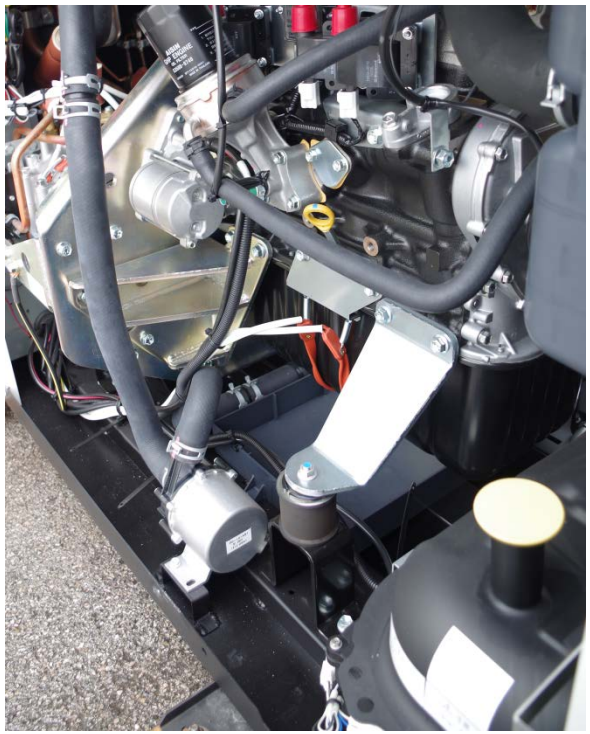
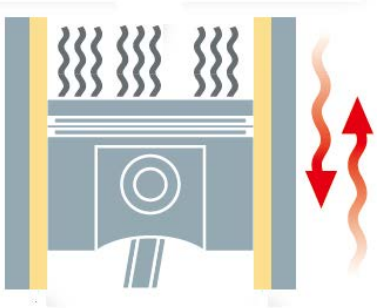
GEHP F – MODEL

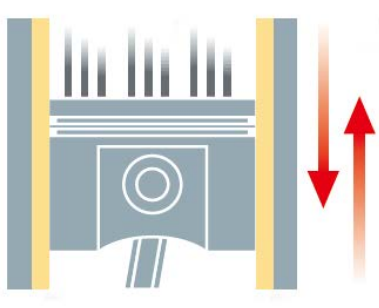
What's new

Engine oil





E model



F model

- Smoother operation
- Engine min speed 500rpm
- Oil leakage pan with integrated safety switch included

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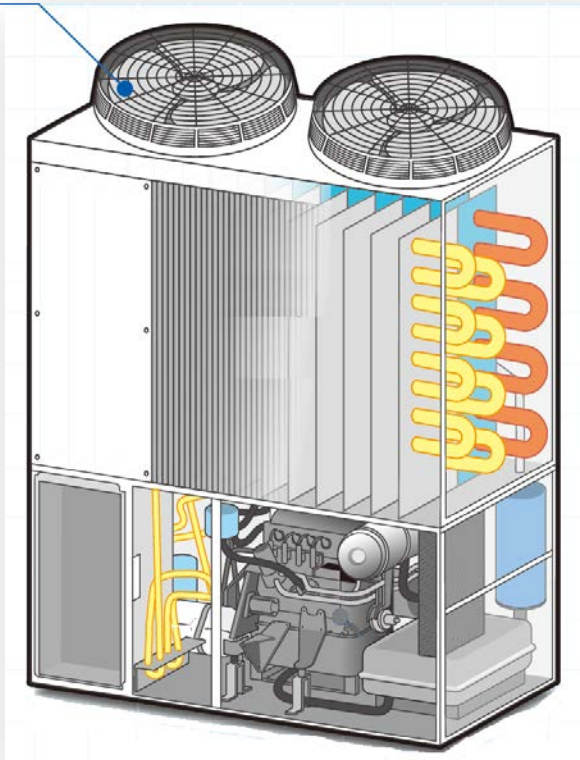
GEHP F – MODEL

What's new

Less noise



- Reduced clearance btw. fan and frame to minimise turbulence
- New combustion engine dampers
- Improved compressor intake piping bracket to reduce vibrations

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AHU KIT

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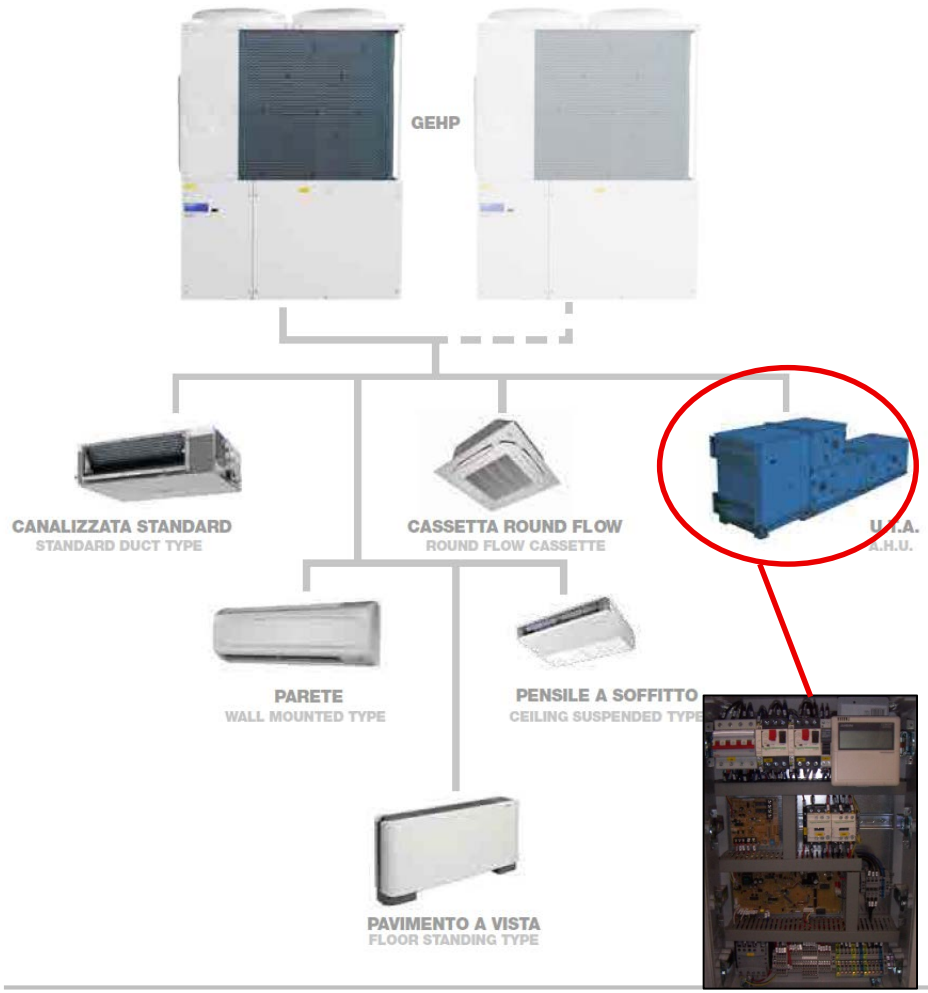
Kit AHU
Main Features



EVKIT 224 – 560

- Compatible with other DX units
- Compatible with standard controllers
- **Constant coil temperature: 45°C Winter 7°C Summer**

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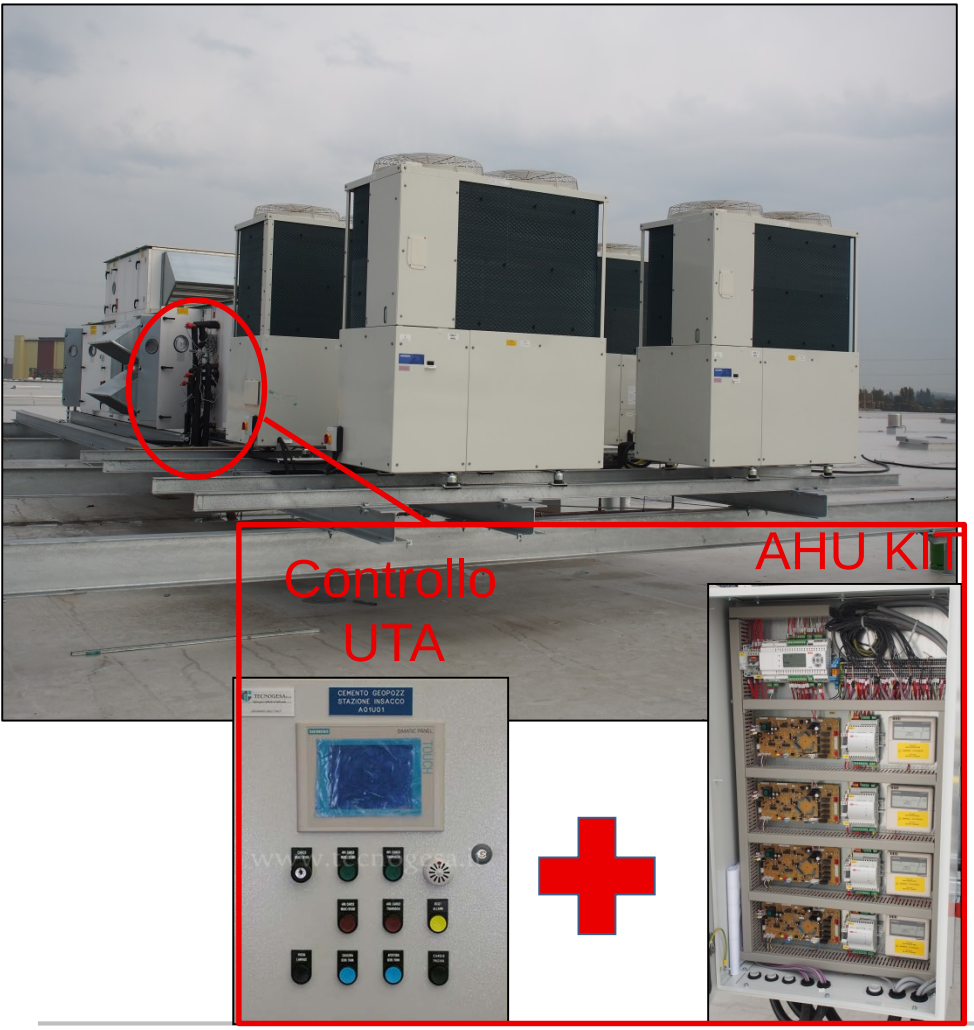
Kit AHU
Main Features



AHU KIT EASY 8 – 120 HP

- Up to 4 GHP
- No design air volume and intake air temperature limitation
- Very usefull in large volume application

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Kit AHU
Main Features

AHU KIT EASY 8 – 120 HP

- **Specific software strictly connected with AWS tecnology**
- **Analogue input for capacity management**
- **It must be controlled by AHU master controller**

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GAS ENGINE HEAT PUMP

Clean Energy for the future

RENEWABLE

SUSTAINABLE

INNOVATIVE

EFFICIENT

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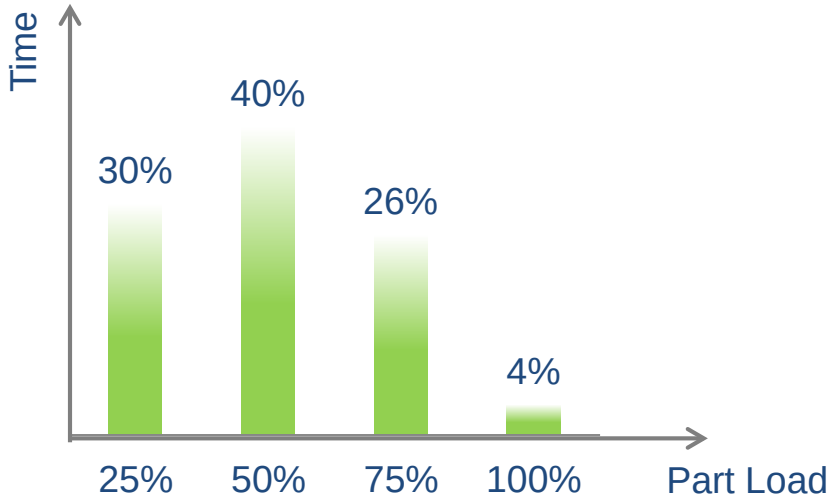
GAS ENGINE HEAT PUMP

Seasonal Efficiency



During normal operation, a heat pump runs primarily at partial load

High seasonal efficiency allows to reduce primary energy consumption, minimizing running costs

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GAS ENGINE HEAT PUMP

Energy Label A++

$$GUE = \frac{\text{Heat/Cool Energy produced}}{\text{Gas consumption}}$$

$$PER = \frac{\text{Heat/Cool Energy prpduced + Engine Heat Recovery}}{\text{Gas consumption}}$$

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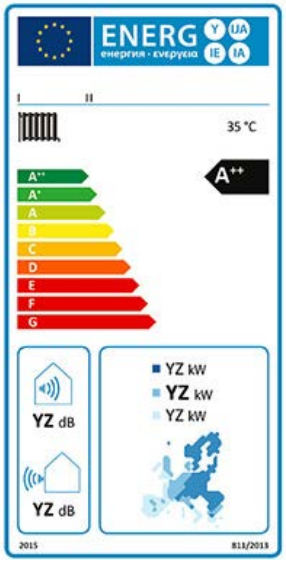
GAS ENGINE HEAT PUMP

Energy Label A++



A++

A+

The new GEHP promote the development of buildings in **ENERGY CLASS A++**

ECO Design ✓

National efficiency limit ✓

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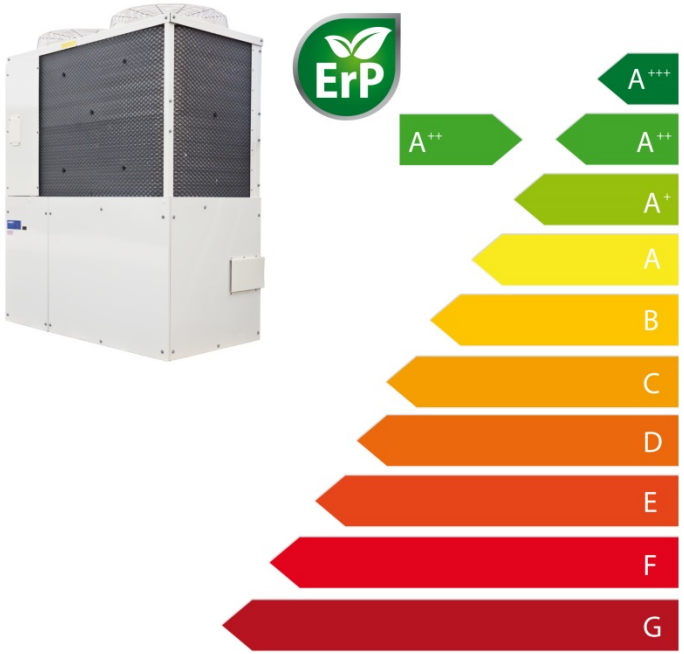
ECO LABEL AND ECO DESIGN

EU dir. 811/2013 and 813/2013

Aisin Air-to-Water line up are in compliance with European Directives standards.



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GAS ENGINE HEAT PUMP

Energy Efficiency

The new **Gas Engine Heat Pumps** allow the design of **nearly zero energy buildings** and the **refurbishment of existing ones**, reducing energetic and economic consumption

NZEB

The energy needed to heat a **NZEB** is **Efficient and Renewable**

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GAS ENGINE HEAT PUMP

Renewable, efficient, sustainable

The high quality of new AISIN Engine Heat Pump

promotes **efficient buildings**

promotes **thermal renewable energies**

complys with the requirements of the **ECODesign** Directive

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GAS ENGINE HEAT PUMP
ECO Innovation

A simple and not frequent ordinary maintenance reduces the environmental impact and the annual costs

Gas engine heat pumps are sustainable

Oil change every 30,000 hours

Few operations of maintenance

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SYSTEMS COMPARISON

Alternative solutions?

BOILER + CHILLER

- Low energy efficiency
- High electric demand and high primary energy consumption
- Boiler room necessary
- Only air-to-water layouts

ELECTRIC HEAT PUMP

- High primary energy consumption
- Performances losses (up to 35%)
- System oversizing to ensure building demand
- High electricity demand
- Frequent defrost cycles

ABSORBTION HEAT PUMP

- Energy performances in cooling mode dramatically drop off
- No reliable system
- High noise levels
- Unit stops for seasonal switch mode (heating to cooling and vice-versa)
- Huge installation spaces needed, evaporative tower

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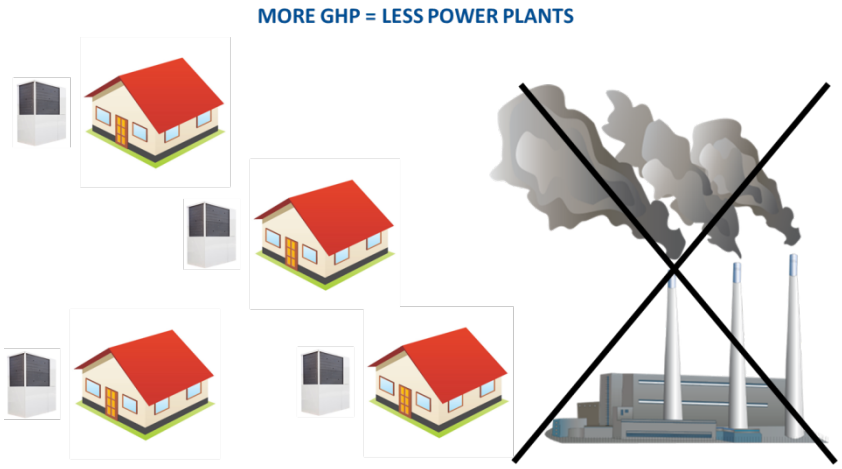
SYSTEMS COMPARISON

Advantages for investors

No need of power sub station for HVAC

Reduced costs for bringing power mains to the HVAC sub station



AC 230V single phase operation (GHP, Indoor units and AWS)

Max consumption for a combination multi system (140 kW) 2,5 kW

Mains fuse for combination multi system 32A

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GAS ENGINE HEAT PUMP
ECO Innovation

In 2017, in **15 main European cities** the annual average emissions of PM10 **exceeded the safety limit value** of 20 µg/mc

0 PM10

-40% CO_2

Nation	City	Annual avarage PM10
Italy	Torino	39
Italy	Milan	37
Spain	Sevilla	29
France	Marceille	29
France	Nice	29
Italy	Rome	28
France	Paris	28
Germany	Stuttgart	24
Spain	Barcelona	24
Germany	Dourtmund	24
Germany	Berlin	24
United Kingdom	Glasgow	23
Fance	Bordeaux	22
United Kingdom	London	22
United Kingdom	Leeds	22

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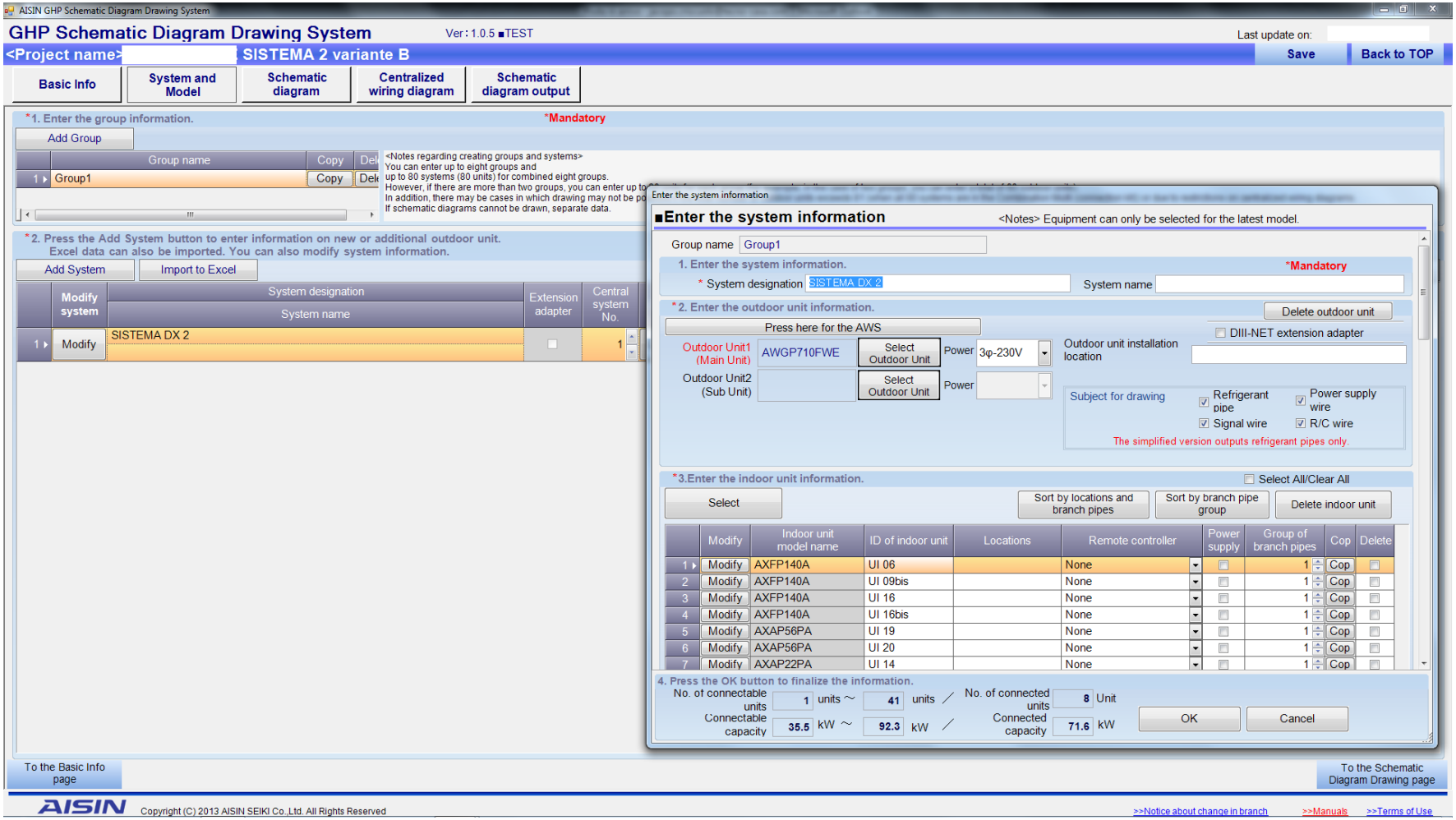
GEHP

Route Map 1



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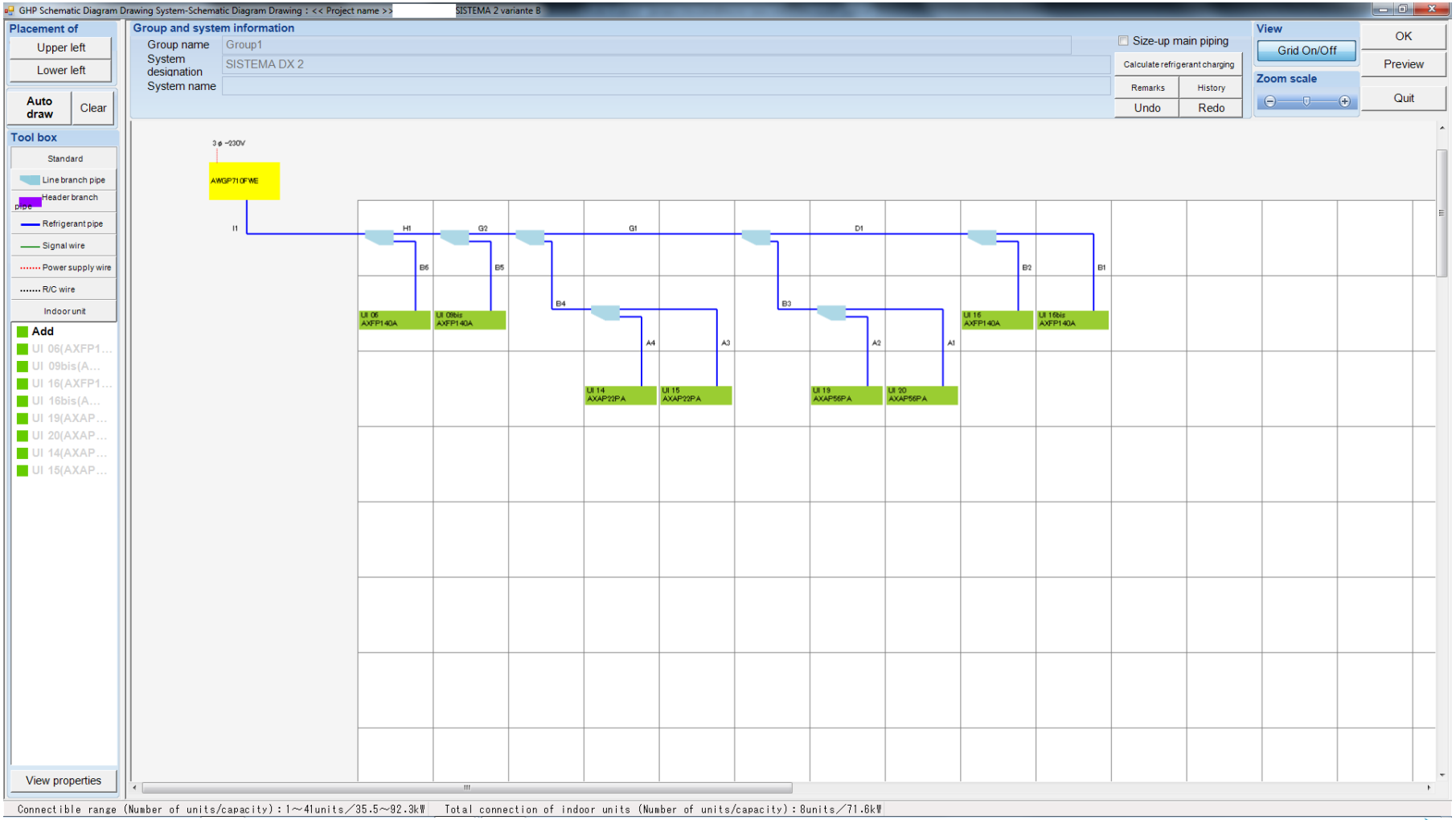
Route Map 2



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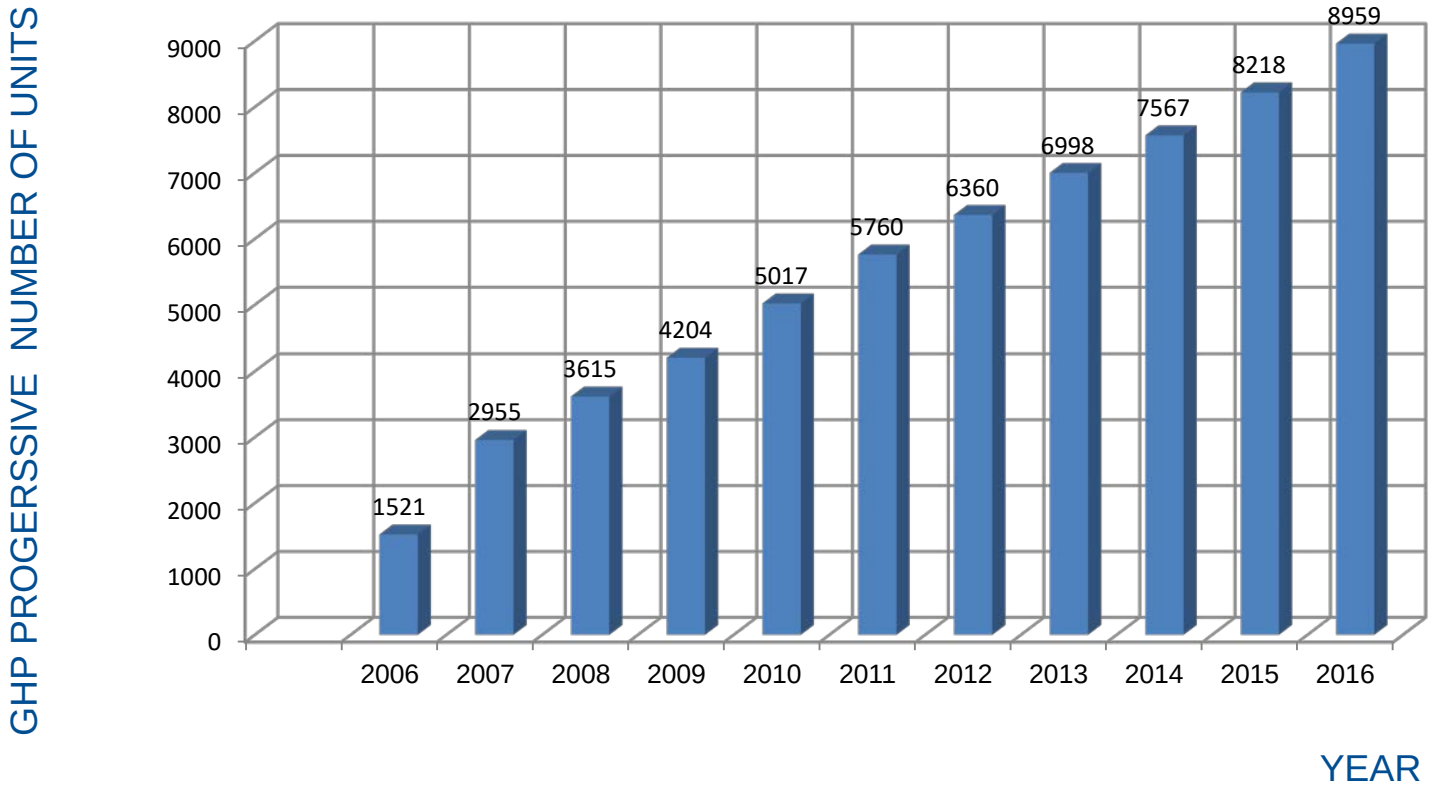
EUROPEAN GHP MARKET

Sales q.ty 2006-2016



Source: GHP Japanese consortium
4 GHP manufactures declared export quantities in Europe

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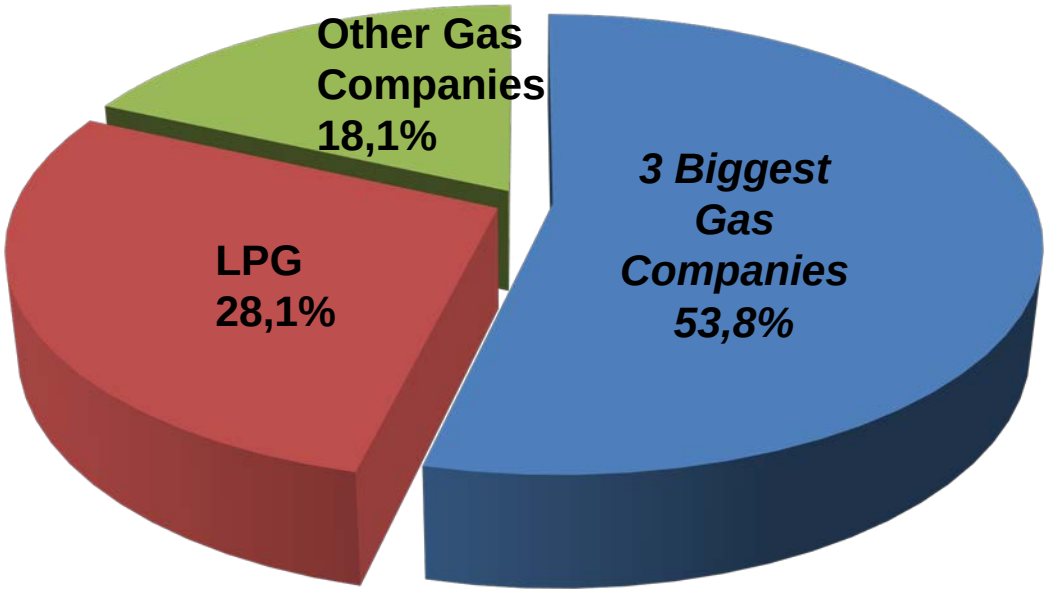
JAPANESE GHP MARKET

Sales q.ty 2002-2016



Around 406,472 UNITS SOLD

Main sales channels in Japan
are **NATURAL GAS and LPG Companies**

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APPLICATIONS

HOTELS, SPA, RESTAURANTS

GYMS, SWIMMING POOLS

COMPANIES (offices, factories, warehouses)

PUBLIC AUTHORITIES

HOSPITALS / NURSING HOME

BANKS

FLATS

OTHER (Churches, schools,

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GEHP / EHP

Cost to produce 1 kWc

cost of electricity	€/kwh	0,1226
cost NG	€/m3	0,2284
	€/kwh	0,024

Prices as at May 2018

	€ /KWh	€/m3	NIS/KWh	NIS/m3
cost NG: USD$ 8 / MMBTU = 26NIS	0,0242	0,2284	0,0887	0,8382
cost of ELECTR: 0,152 US$/KWh= 0,55NIS	0,1266/kwh		0,55NIS/kwh	
cost of LPG: US$ 0,97 / Kg=3,5NIS = 0,80Kg	0,059/kWh		3,5NIS/kg	

GAS HEAT PUMP con **Dx**

		kW	RT	cons KW	cons m3/h	cost €/kWhc	cost €/RThc	GUE	K1 cost of kwh energy produced (cost of kwh NG/GUE)	cost of RT energy produced (cost in KWh x 3,517)	
GHP AISIN	GHP8	22,4	6,4	15	1,6	0,01621	0,057	1,493	0,01621	0,057	
	GHP10	28	8,0	19,2	2,0	0,01659	0,058	1,46	0,01659	0,058	
	GHP13	35,5	10,1	26,4	2,8	0,01800	0,063	1,34	0,01800	0,063	
	GHP16	45	12,8	31	3,3	0,01667	0,059	1,45	0,01667	0,059	
	GHP20	56	15,9	40,7	4,3	0,01759	0,062	1,38	0,01759	0,062	
	GHP25	71	20,2	55,1	5,8	0,01878	0,066	1,29	0,01878	0,066	K3>K1
	GHP30	85	24,2	67,8	7,2	0,01930	0,068	1,25	0,01930	0,068	43%
									K2		48%

GAS HEAT PUMP con **AWS** — 50%

		kW	RT	cons KW	cons m3/h	cost €/kWhc	cost €/RThc	*GUE*	cost €/kWhc	cost €/RThc	53%
GHP AISIN	GHP8	21	6,0	15	1,6	0,01729	0,061	1,400	0,0173	0,061	57%
	GHP10	26,5	7,5	19,2	2,0	0,01753	0,062	1,380	0,0175	0,062	46%
	GHP13	33,5	9,5	26,4	2,8	0,01907	0,067	1,269	0,0191	0,067	45%
	GHP16	41,5	11,8	31	3,3	0,01808	0,064	1,339	0,0181	0,064	
	GHP20	52	14,8	40,7	4,3	0,01894	0,067	1,278	0,0189	0,067	
	GHP25	63	17,9	55,1	5,8	0,02117	0,074	1,143	0,0212	0,074	K3>k2 %
	GHP30	74,5	21,2	67,8	7,2	0,02202	0,077	1,099	0,0220	0,077	39%
											45%
									K3		47%

ELECTRIC HEAT PUMP con Dx — 49%

		kW	RT	cons KW		cost €/kWhc	cost €/RThc	COP	cost €/kWhc	cost €/RThc	53%
DAIKIN RYYQ	EHP8HP	22,4	6,4	5,21		0,0285	0,100	4,30	0,0285	0,100	39%
	EHP10HP	28	8,0	7,29		0,0319	0,112	3,84	0,0319	0,112	37%
	EHP13HP	35,5	10,1	10,5		0,0363	0,128	3,38	0,0363	0,128	
	EHP16HP	45	12,8	13		0,0354	0,125	3,46	0,0354	0,125	
	EHP20HP	56	15,9	18,5		0,0405	0,142	3,03	0,0405	0,142	
	EHP25HP	71	20,9	20		0,0345	0,117	3,55	0,0345	0,121	
	EHP30HP	83,9	23,9	24		0,0351	0,123	3,50	0,0351	0,123	

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WHY SELECT GEHP for your COOLING and HEATING needs

ADVANTAGES			
GEHP	**EHP**	**REQUIRMENT**	**RESULT**
Single phase max 1,49 Kw /main fuse 32A	same capacity need 24kw	EHP need transformer	additional cost to the installation
production of hot sanitary water from recover energy	no sanitary water production	installation of gas/electric boiler	additional cost to the installation
Low CO_2 emissions	40% higher than GEHP		need to buy green certificates to compensate CO_2 emissions
Stable capacity at close to zero degrees outdoor temp	capacity drop up to 35%	additional EHP to compensate	additional cost to the installation
zero emissions of PM 10	High emissions of PM10		contribute to atmospheric pollutions
High seasonal efficiency due to Hot Sanitary Water production	Not applicable for EHP		
Gas Engine Heat Pumps allow the design of **nearly zero energy buildings** and the refurbishment of existing ones, reducing energetic and economic consumption . By increasing the building energy rating, the value of the building increases accordingly.	Not applicable for EHP		
Long maintenance intervals (10.000h) OR 3/4 years= 500.000km of a car maitenance	yearly maintenance		higher cost

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GEHP

Clean Energy for the Future

תודה לך על תשומת הלב

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