

Free Cooling Technology

Utilise low ambient temperatures to save energy and reduce your cooling costs by up to 70%



Free Cooling for industrial process and air conditioning



How Free Cooling can save you money

Free Cooling is a fast and effective, economic method of utilising low external air temperatures. It can be used to assist in cooling water for industrial temperature control applications or in HVAC systems.

A chillers' traditional design utilises integral compressor technology to generate the cooling required for process and HVAC applications.

The use of Free Cooling in an industrial temperature control application differs from an environmental cooling solution as fresh ambient air cannot be drawn straight into the cooling circuit. Therefore, to harness the benefits of the low ambient temperatures, a Free Cooling coil needs to be introduced to the circuit.

A Free Cooling coil is installed in series with the chiller system's evaporator, so in lower ambient conditions, partial or 100% Free Cooling can be achieved. This method of operation, utilises the naturally low ambient temperatures and in doing so benefits from a reduction in energy costs of up to 70%.

As the ambient air temperature drops at least a degree below the process return water temperature, the benefits of Free Cooling can begin to be realised and the external ambient temperature can begin to cool a process in place of a chiller. As the ambient temperature drops 3°C to 5°C below the required process supply water temperature total Free Cooling can be achieved, taking over from the chillers' compressors 100% and consequently providing an environmentally friendly and cost effective approach to process and HVAC cooling.

There are two main options available to achieve Free Cooling

Chiller working alongside an Independent Free Cooler



Chiller with Integral Free Cooling coil



As a leading supplier of temperature control solutions ICS Cool Energy is able to offer Free Cooling systems for both sale and hire to ensure customers achieve the greatest energy savings to suit their business and application requirements.

Harness the Benefits of Free Cooling

Whichever avenue of Free Cooling is adopted the benefits remain constant:

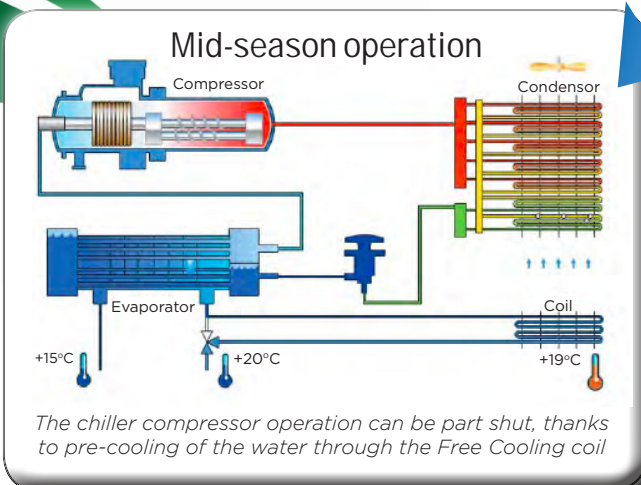
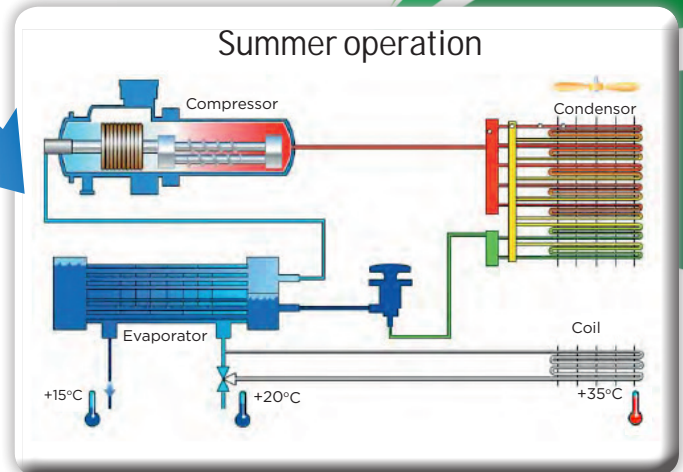
- System reliability is maintained as each system monitors temperature and automatically switches from 100% compressor load to partial or total Free Cooling as the climate conditions allow
- Each method utilises the ambient air temperature in place of compressors creating the low temperatures needed to cool the fluid saving energy and consequently running costs
- By utilising Free Cooling technology, there is less wear and tear on chiller components and consequently a reduced life-cycle cost

How it works

The Free Cooling concept is illustrated here:

High Ambient - summer operation

When the process return water temperature required is equal to or higher than the ambient air temperature Free Cooling is not suitable. The system's three way valve will continue to direct the fluid flow through the chillers' compressors to be cooled to the required set point temperature.

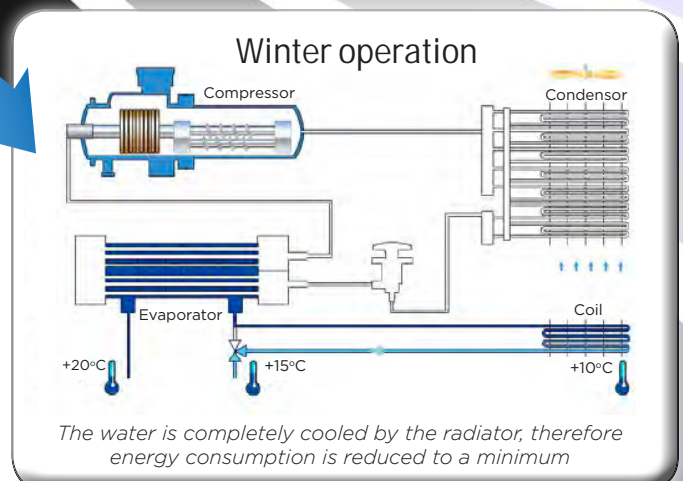


Mid Season Operation

For mid-season operation the water is partially cooled by the compressor and partially by the ambient temperatures. The percentage of Free Cooling achieved mid-season is dependent on seasonal temperatures although partial Free Cooling commences when the ambient air temperature is 1°C below the process return water temperature. The water is partially cooled through the Free Cooler then flows through the chillers' compressors to achieve the required set point temperature.

Winter Operation

In winter, when outdoor temperatures are low enough, the water is chilled solely by the Free Cooling coil. This allows the chillers' compressors to stop operating, saving significant amounts of energy. This can be achieved once the ambient air temperature is 3°C - 5°C below the process supply water temperature. The only electrical power used in winter operation is for fan operation.



A closer look at the cost savings

The following energy analysis compares a standard screw compressor chiller against a 'Class A' rated scroll compressor with a Free Cooling unit.

Running Cost Example

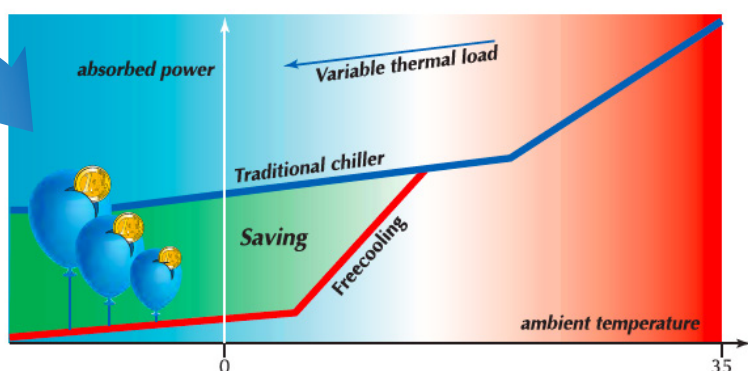
The design parameters are:

	X2 Screw Compressor Chiller	'Class A' Scroll Compressor Chiller		Free Cooler	'Class A' Scroll Compressor Chiller with Free Cooler
Cooling Capacity			Cooling Capacity		
Ambient 25°C	566.2kW	596.7kW	Ambient 10°C	580kW	
Ambient 30°C	543.6kW	567.1kW	Ambient 18°C	116kW	
Power Input					
Ambient 25°C	127.5kW	110.6kW	100% Free Cooling	10°C	
Ambient 30°C	142.3kW	120.kW	Duty	580kW	
Fan Consumption	9.60kW	16.00kW	Fan consumption	7.2kW	
Evaporation Temperature inlet	20°C	20°C	Evaporation Temperature inlet	20°C	
Evaporation Temperature outlet	15°C	15°C	Evaporation Temperature outlet	15°C	
Energy used (kWh) operation per year	852,149	781,969	Energy used (kWh) operation per year	40580.90	231,838
Cost of above energy @ £0.10/kWh	£85,214.87	£78,196.94	Cost of above energy @ £0.10/kWh	£4058.09	£23,183.84

The analysis shows that in a 2 year period the Chiller/Free Cooling package provides a high level of savings that offer payback for the new system within 20.5 months* and substantial energy savings thereafter when compared to the x2 screw compressor chiller.

See the savings for yourself

The illustration on the right shows how Free Cooling savings are achieved in varying thermal load conditions when compared with a standard chiller system.



Hire Options

ICS Cool Energy's hire division has helped many customers overcome equipment shortfalls during chiller replacements and breakdowns throughout the winter months.

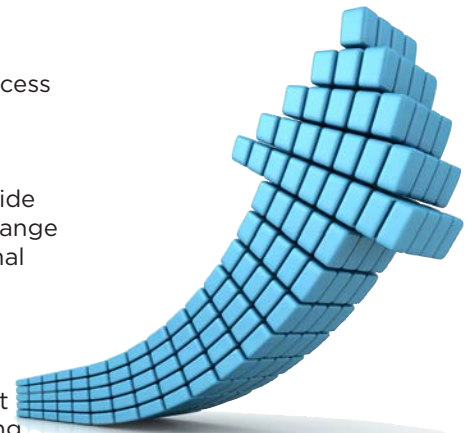
**20.5 months payback incorporates unit capital cost and savings generated over a 24 month period.*

Free Cooler to run alongside a standard process chiller

Energy savings of up to 70% can be achieved with maximum savings for higher process temperatures. Systems can achieve payback within 2 years with substantial savings thereafter.

Achieve maximum Free Cooling benefits with an external Free Cooler to run alongside an existing chiller. An independent Free Cooler has a greater capacity for heat exchange as it is sized to maximise efficiency enabling a greater area for the transfer of thermal energy.

Free Cooling can be applied to both new chillers and existing units through the use of Air Blast Coolers with Free Cooling diverter valves (Free Coolers) which are uniquely balanced for each application to provide the greatest levels of efficiency at full and partial loads. If an existing chiller is currently installed to meet a site's cooling requirements, a Free Cooler can be added to run in line with the pre-existing unit in order to offer all of the Free Cooling benefits.



The main advantages of utilising an existing chiller is the reduced start up costs as the existing chiller can remain in service with the added support of a Free Cooler. Once the Free Cooler takes over from the chiller, the full benefits of Free Cooling are realised, energy consumption and costs are significantly reduced as is the wear and tear on the chiller components, ultimately extending a unit's life cycle.

Where a chiller replacement is being considered ICS Cool Energy can provide 'Class A' rated chillers which offer inverter controls and enhanced efficiency ratios which further reduce running costs when operating in low ambients at full load conditions.

ICS Cool Energy can provide a fully inclusive installation and pipework service should a site require an upgrade or retrofit solution for a cooling system, furthermore with a dedicated hire division ICS Cool Energy can support a site throughout plant upgrades and services with an extensive fleet of energy efficient 'A' rated cooling and heating equipment.

Depending on individual requirements and specifications ICS Cool Energy can provide a Free Cooler for closed circuit water cooling to within 5°C of ambient dry bulb temperature. Alternatively, for closed circuit water cooling to within 6°C of the ambient wet bulb temperature, giving a cost-effective alternative to evaporative cooling towers with the additional advantage of no chemical water treatment, cleaning or chlorination requirements.

Integral Free Cooling

Where space is limited, Free Cooling can still be achieved with ICS Cool Energy's unique range of chillers with integral Free Cooling coils. The units are designed to the highest energy efficiency levels in all seasonal conditions and their compact footprint enables them to be easily roof mounted.

ICS Cool Energy offer a reliable and flexible range of chillers with integral Free Cooling coils. Units are available in over 20 sizes across 3 ranges with added variations including low noise and high-efficiency.

APTUS Free Cooling

Further system benefits include:

- Modulation 3-way valve (optional) provides improved outlet temperature control even in low ambient conditions
- Hermetic rotary scroll compressors optimised to work with the ozone friendly R410A
- The highest energy levels are achieved thanks to the microprocessor based electronic control system which manage the full range of cooling capacity by mixing the compressor's workload and the Free Cooling action
- Axial fans and plate heat exchangers feature within this range, providing high quality performances
- Generous sizing of Free Cooling coils
- High precision and instantaneous control of water outlet temperature
- Individually and thoroughly tested in a chamber



AT-FC-WG/SS			2015	2018	2020	2025	2030	2035	2041	2045	2051	2055	2061	4060	4070	4080	4090	4100	4110	4120	4140	4160
Power supply		V/ph/Hz	400/3/50																			
PERFORMANCE																						
FREE COOLING OFF																						
Cooling capacity	-1	kW	41,5	49,8	56,9	63,8	84,2	97,9	112	122	137	156	179	166	193	216	243	274	313	351	402	445
Total power input	-1	kW	14,2	16,1	19,0	21,7	27,8	32,2	35,5	41,1	45,5	53,0	58,9	56,9	65,9	74,9	83,2	89,9	103	119	132	150
EER	-1		2,92	3,09	2,99	2,94	3,03	3,04	3,15	2,98	3,02	2,94	3,04	2,92	2,92	2,88	2,92	3,05	3,02	2,95	3,04	2,96
FREE COOLING ON 100%																						
Cooling capacity	-2	kW	41,5	49,8	56,9	63,8	84,2	97,9	112	122	137	156	179	166	193	216	243	274	313	351	402	445
Total power input	-2	kW	0,62	1,50	1,50	1,72	1,72	2,58	2,58	2,58	3,44	3,44	4,40	3,44	5,16	5,16	5,16	5,16	5,16	6,88	6,88	8,60
EER	-2		66,9	33,2	37,9	37,1	49,0	37,9	43,3	47,4	39,9	45,2	40,7	48,3	37,3	41,8	47,1	53,1	60,7	51,0	58,4	51,8
Total FC temperature	-2	°C	-3,0	-3,5	-2,9	-3,2	-3,1	-3,1	-2,5	-3,3	-3,5	-3,5	-4,7	-3,4	-3,6	-5,2	-3,3	-4,4	-4,5	-4,5	-4,4	-4,4
EXCHANGERS																						
Heat exchanger user side in refrigeration																						
Water flow	-1	m³/h	7,91	9,50	10,9	12,2	16,1	18,7	21,3	23,3	26,2	29,7	34,2	31,7	36,7	41,1	46,3	52,2	59,7	66,9	76,7	84,9
Pressure drop	-1	kPa	127	125	113	112	135	112	110	117	113	114	110	137	151	153	142	150	157	164	158	161
COMPRESSORS																						
Compressors nr.	N°	2	2	2	2	2	2	2	2	2	2	2	2	4	4	4	4	4	4	4	4	4
No. Circuits	N°	1	1	1	1	1	1	1	1	1	1	1	1	2	2	2	2	2	2	2	2	2
NOISE LEVEL																						
Noise Pressure*	-3	dB(A)	46	47	47	48	49	50	50	51	52	53	54	50	51	51	52	52	53	54	53	54
Noise Power*	-4	dB(A)	78	79	79	80	81	82	82	83	84	85	86	82	83	83	84	84	85	86	86	87
SIZE AND WEIGHT																						
A	-5	mm	2200	2602	2602	2602	3602	3602	4602	4602	4602	4602	4602	4110	4110	4110	5110	5110	5110	5110	6110	6110
B	-5	mm	920	1104	1104	1104	1104	1104	1104	1104	1104	1277	1277	2220	2220	2220	2220	2220	2220	2220	2220	2220
H	-5	mm	1780	2175	2175	2175	2175	2175	2205	2175	2205	2350	2350	2150	2150	2150	2150	2150	2430	2430	2430	2430
Operating weight	-5	Kg	730	910	970	990	1300	1450	1690	1730	1810	2060	2150	2590	2730	2910	3250	3420	3820	3970	4440	4630

* dB(A) at 10m distance

Aries Free Cooling

High efficiency chillers with integrated Free Cooling

Further system benefits include:

- Generous sizing of Free Cooling coils
- High precision and instantaneous control of water outlet temperature
- User friendly microprocessor with icon based graphic interface
- Easy installation and maintenance with easily accessible internal components
- Individually and thoroughly tested in a chamber
- Extremely quiet chiller operation, thanks also to the use of axial fans with a specially designed blade profile
- Environmentally friendly, with the implementation of R407C refrigerant (which does not harm the ozone layer)
- Fully packaged Aries units include process style integral pump and tank



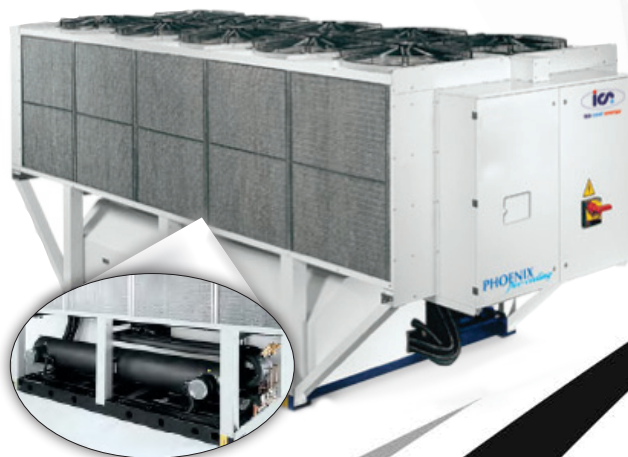
Model Aries FC			201	251	301	351	401	501	551	601	701	751
FREE Cooling off	Cooling capacity (1)	kW	50.9	54.6	69.3	80.1	97.6	115	133	146	161	177
	Absorbed power (1)	kW	16.2	19.3	20.0	30.1	34.3	40.1	44.4	50.7	52.7	60.1
	Max external air temperature (1)	°C	45	47	47	42	44	43	43	41	45	43
TOTAL Free Cooling	Cooling capacity (1)	kW	50.9	54.6	69.3	80.1	97.6	115	133	146	161	177
	Absorbed power (1) *	kW	1.6	2.3	2.3	4.0	4.0	4.0	4.0	4.0	6.0	6.0
	Total free cooling (1)	°C	1.0	1.4	-0.3	1.6	0.5	-0.7	0.4	-0.7	1.4	0.4
FREE Cooling off	Cooling capacity (2)	kW	46.5	49.5	63.1	72.8	88.6	105	121	133	147	162
	Absorbed power (2)	kW	15.7	18.8	19.5	29.0	33.1	38.5	42.7	48.6	50.8	57.8
	Max external air temperature (2)	°C	46	48	48	44	45	44	44	43	46	45
TOTAL Free Cooling	Cooling capacity (2)	kW	46.5	49.5	63.1	72.8	88.6	105	121	133	147	162
	Absorbed power (2) *	kW	1.6	2.3	2.3	4.0	4.0	4.0	4.0	4.0	6.0	6.0
	Total free cooling (2)	°C	-1.1	-0.7	-2.3	-0.6	-1.5	-2.5	-1.5	-2.5	-0.6	-1.6
ESEER		-	4.19	3.82	4.07	3.56	3.73	3.79	3.97	3.94	3.91	3.75
Power supply		V/Ph/Hz	400 3 10% / 3 - PE / 50									
Circuits / Compressors		N°	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2	1/2
Sound pressure level Free cooling OFF (N)		dB(A)	60.2	60.2	61.5	62.6	61.6	61.6	61.6	61.6	62.3	62.3
Sound pressure level Free cooling OFF (SN)		dB(A)	-	-	-	56.2	55.0	55.0	55.0	55.0	55.2	55.2
Sound pressure level Free cooling OFF (SSN)		dB(A)	-	-	-	48.9	48.9	47.7	48.7	48.7	49.1	49.1
Depth		mm	2550	2550	2550	3495	3495	3495	4595	4595	4595	4595
Width		mm	1400	1400	1400	2188	2188	2188	2188	2188	2188	2188
Height		mm	2136	2136	2136	1989	1989	1989	1989	1989	1989	1989
Installed weight		Kg	1494	1494	1509	1858	1980	2276	2536	2541	2752	2803

Phoenix Free Cooling

High efficiency chillers with integrated Free Cooling

Further system benefits include:

- Generous sizing of Free Cooling coils
- High precision and instantaneous control of water outlet temperature
- User friendly microprocessor with icon based graphic interface
- Easy installation and maintenance with easily accessible internal components
- Individually and thoroughly tested in a chamber
- Extremely quiet chiller operation, thanks also to the use of axial fans with a specially designed blade profile
- Environmentally friendly, with the implementation of R407C refrigerant (which does not harm the ozone layer)
- Fully packaged Phoenix units include process style integral pump and tank



Model Phoenix FC			0801	0901	1101	1251	1401	1602	1702	1802	2002	2202
Free Cooling OFF	Cooling capacity (1)	kW	187	218	264	306	362	373	395	412	468	494
	Total absorbed power (1)	kW	68	79	93	105	119	136	151	165	176	195
	Max external air temperature vers. C (1)	°C	43	43	42	44	44	43	42	40	41	39
	Max external air temperature vers. SF (1)	°C	45	46	46	46	44	43	-	-	-	-
TOTAL free Cooling	Cooling capacity (1)	kW	187	218	264	306	362	373	395	412	468	494
	Absorbed power (1) *	kW	6	8	8	10	12	12	12	12	14	14
	Total free cooling (1)	°C	-0.2	-1.6	-2.0	-0.6	0.1	-0.2	-0.8	-1.3	-0.6	-1.3
Free Cooling OFF	Cooling capacity (2)	kW	170	198	239	278	329	339	360	376	425	449
	Total absorbed power (2)	kW	65	75	88	101	114	130	144	158	167	185
	Max external air temperature vers. C (2)	°C	45	44	44	45	45	45	43	42	43	41
	Max external air temperature vers. SF (2)	°C	46	47	47	48	45	45	-	-	-	-
TOTAL free Cooling	Cooling capacity (2)	kW	170	198	239	278	329	339	360	376	425	449
	Absorbed power (2) *	kW	6	8	8	10	12	12	12	12	14	14
	Total freecooling (2)	°C	-2.1	-3.4	-3.7	-2.4	-1.8	-2.1	-2.7	-3.1	-2.4	-3.0
ESEER		-	3.44	3.72	3.63	3.6	3.98	3.48	3.62	3.65	3.55	3.42
IPLV		-	3.50	3.78	3.66	3.66	4.05	3.61	3.80	3.83	3.78	3.64
Power supply		V/Ph/Hz	400±10%/3/50									
Circuit / Compressors		N°	1/1	1/1	1/1	1/1	1/1	2/2	2/2	2/2	2/2	2/2
Free cooling noise level OFF vers. C		dB(A)	62.0	63.2	62.6	63.6	65.0	65.5	65.6	65.7	66.9	66.9
Free cooling noise level OFF vers. SC		dB(A)	55.4	56.3	56.0	57.0	59.0	59.1	59.3	59.4	60.5	60.6
Free cooling noise level OFF vers. SF		dB(A)	55.7	56.1	56.3	57.2	59.1	59.2	-	-	-	-
Free cooling noise level OFF vers. SSF		dB(A)	49.1	49.5	49.8	50.6	51.0	51.5	-	-	-	-
Depth		mm	2190	2190	2190	2190	2190	2190	2190	2190	2190	2190
Width		mm	3675	4590	4590	5490	6425	6425	6425	6425	7360	7360
Height		mm	2350	2350	2350	2350	2350	2350	2350	2350	2350	2350
Installed weight		Kg	2623	3306	3814	4648	5003	5273	5385	6089	6133	6154

Contact

www.icscoolenergy.nl
+31 (0)88 - 258 2580

www.icscoolenergy.be
+32 (0)800 - 29110