ZKMA TE Chiller Introduction

Anhui Zhongke Xinyuan Semiconductor Co., Ltd.

About Us

Who we are

A China local company, founded in 2017 specialized in thermoelectric temperature system.
The word’s class thermoelectric products and solution provider with focus on semiconductor, LED, 5G Wireless, medical equipment and electrical car etc. industry.

What we do

We are driven by technology and innovation to drive the industry to lowest COO.

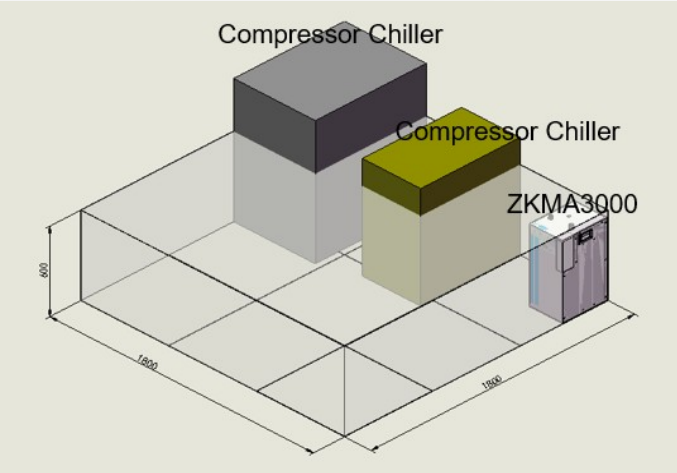
What we offer

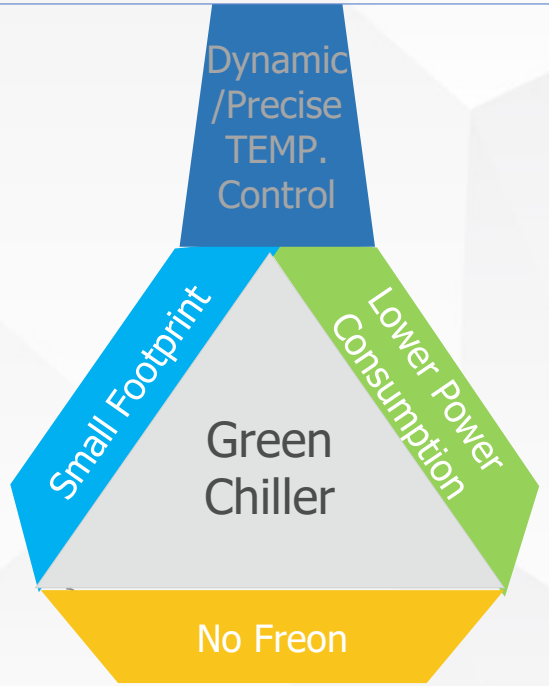
Strong worldwide presence with own sales and service organizations for best customer support and fast ramp-up on-site process support

Our TE chiller Advantages

Improved first 3 wafers low yield concerns and better CD control.

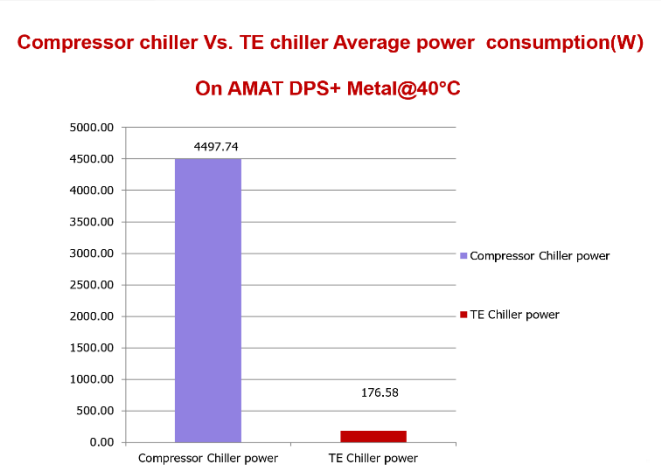
Minimize footprint, saving more spaces in cleanroom.



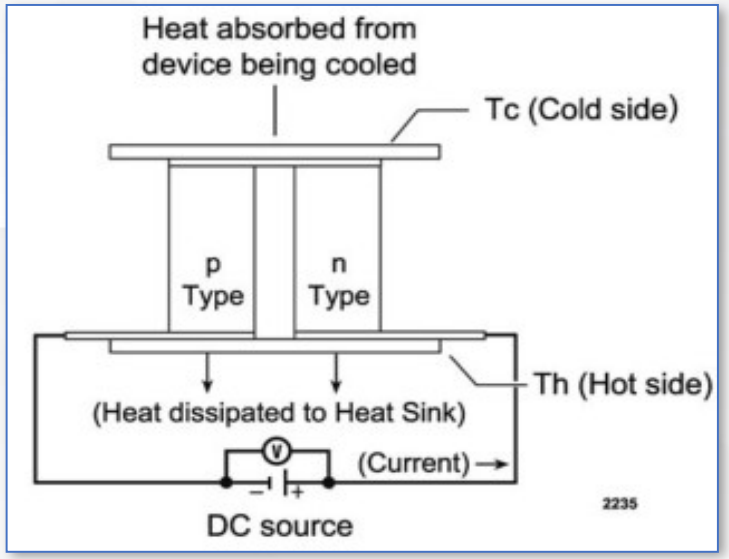


Not using Freon anymore.

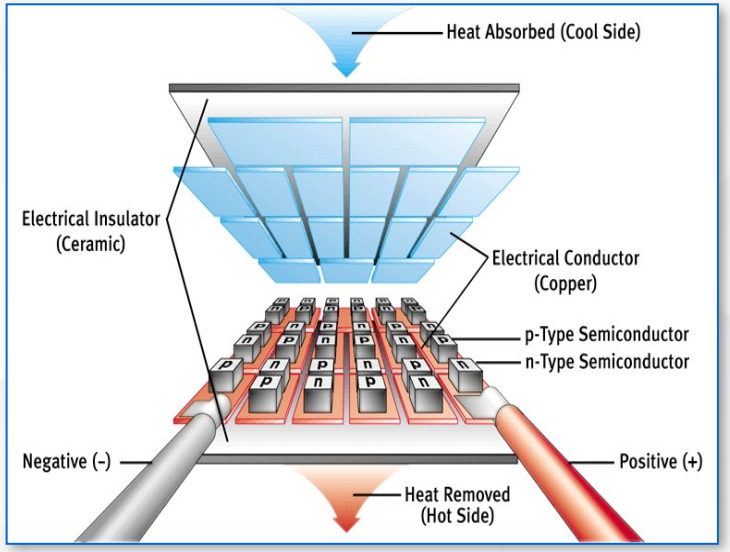
Only 10%-20% power consumption comparing with static chiller.



TE Basics of Technology



Peltier discovered that heat is released or absorbed when two dissimilar materials that conduct electrical current are joined. A positive voltage applied to the n-type material drives electrons from the p-type to the n-type material and back to the voltage supply. The temperature on the cold side decreases as heat is absorbed. The heat is then conducted through the couple to the hot side to dissipate through a heat sink. The heat dissipated is the sum of the heat removed from the cold side and the heat generated by the thermoelectric input power. Reversing the voltage polarity changes the hot side of the couple to the cold side.



- small & stable
- no moving parts
- proven reliable >50,000hrs (MTF 5.8 years)
- no noise
- temperature control ± 0.1° C
- no CFCs

TE Basics of Technology (Peltier Effect)

- Dynamic temperature control;
- Synchronized with process;
- Minimized 1st wafer effect;
- Improved CD Bias;
- Smallest footprint in the industry;
- Sub-floor mount capable;
- Lowest power consumption;
- Modular design;
- Multi-platform interface capability;
- Only one (1) moving part (pump).

Specification

Model		Z-3000	Z-6000	Z-6000P
Temp. Control	Range	-20℃～+90℃	-20℃～+90℃	-20℃～+90℃
	Accuracy (Idle)	±0.1℃	±0.1℃	±0.1℃
	Accuracy (Running)	±1 ℃	±1 ℃	±1 ℃
	Model	PID	PID	PID
Compressor		NA	NA	NA
Refrigerant		Fluorinet (FC-3283 3M)	Fluorinet (FC-3283 3M)	Fluorinet (FC-3283 3M)
Cooling Capacity		1200W@20℃	2400W@20℃	3000W@20℃
Pump		0.08 kw Magnetically-coupled pump	0.08 kw Magnetically-coupled pump	0.08 kw Magnetically-coupled pump
Coolant Flow		4GPM@30psi	4GPM@30psi	5GPM@30psi
Tank		1.5L	3L	3L
Interface Type		RS485/232, Analog DI/O, LonWorks, Device net	RS485/232, Analog DI/O, LonWorks, Device net	RS485/232, Analog DI/O, LonWorks, Device net
Power Consumption		30A	30A	30A
Power Supply		3-phase, AC208V±10%, 50/60Hz	3-phase, AC208V±10%, 50/60Hz	3-phase, AC208V±10%, 50/60Hz
Dimensions		Chiller: H492mm x D460mm x W145mm	Chiller: H492mm x D460mm x W230mm	Chiller: H492mm x D460mm x W230mm
		Controller: H125mm x D564mm x W433mm	Controller: H125mm x D564mm x W433mm	Controller: H125mm x D564mm x W433mm
Weight		Chiller: 25KG	Chiller: 30KG	Chiller: 30KG
		Controller: 20KG	Controller: 25KG	Controller: 25KG

ZKMA TE Chiller Compare Vs. Compressor Chiller

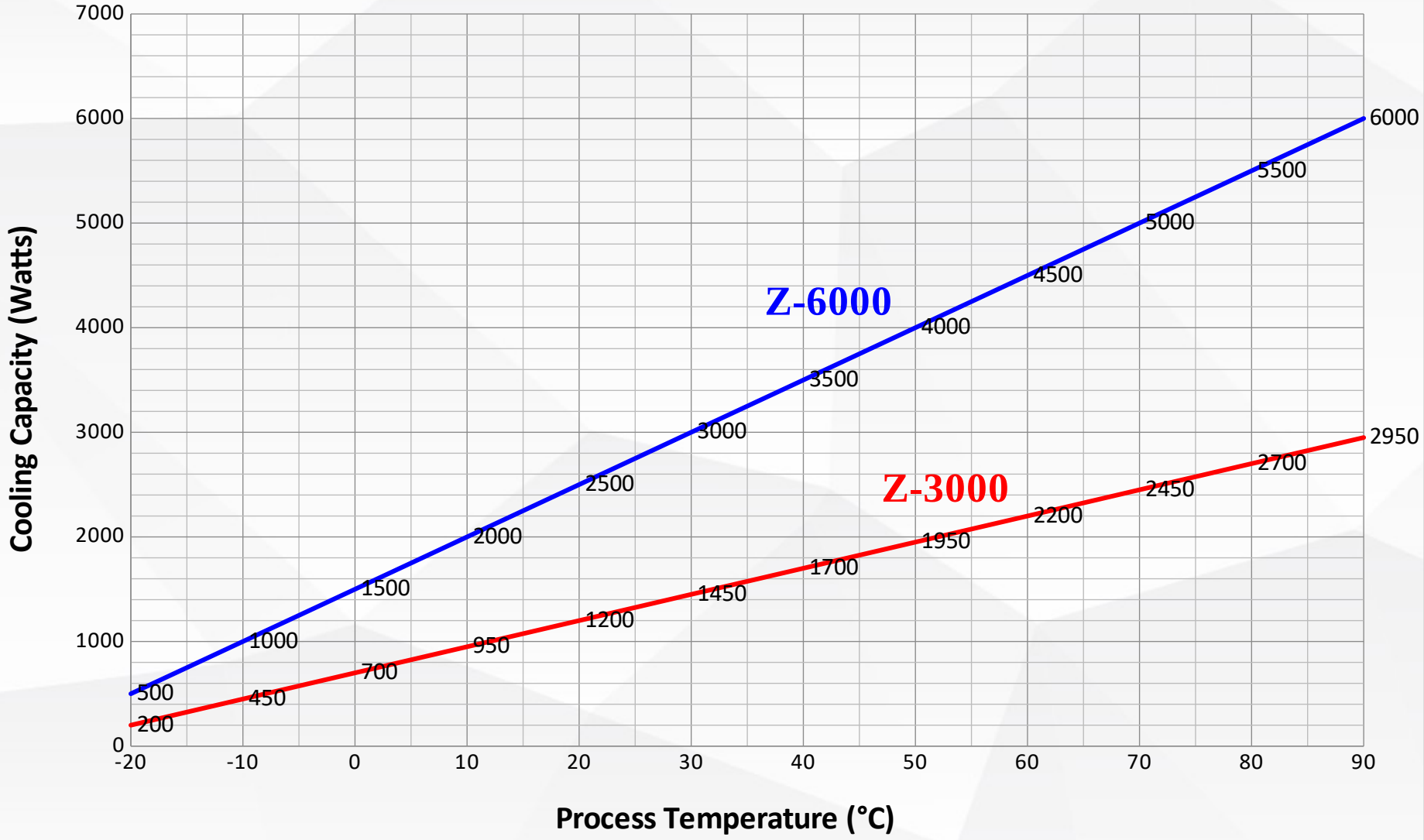
Specifications	Description				
Manufactory	ZKMA Z-3000	ZKMA Z-6000	ATS DEX－20A	SMC HX2000	NESLAB HX 150
Type	Themoelectric cooling	Themoelectric cooling	Water-cooled refrigeration	Water-cooled refrigeration	Water-cooled refrigeration
Refrigerator	No	No	Yes	Yes	Yes
Temp Range	-20 ℃ to +90℃	-20 ℃ to +90℃	-20 ℃ to +80℃	20℃ － +90℃	5 ℃ to +90℃
Temp Accuracy	±0.1℃	±0.1℃	±1℃	±2℃	±0.5℃
Cooling Capacity	1500W@20°C	3000W@20°C	3500W@20°C	6000W@25°C	4500W@20°C
Reservoir Volume	1.5Liters	3Liters	20Liters	15Liters	24Liters
Coolant Usage	1.5Liters(Reservior)+4Liters(Pipe line)=5.5L	3Liters(Reservior)+4Liters(Pipe line)=7L	20Liters(Reservior)+10Liters(Pipe line)=30L	15Liters(Reservior)+9Liters(Pipe line)=24L	24Liters(Reservior)+9Liters(Pipe line)=33L
1 Liter=￥759	**￥4,175**	**￥5,313**	**￥22,770**	**￥18,216**	**￥25,047**
Coolant	FC-3283 or FC-8270 HT-135 or HT-200	FC-3283 or FC-8270 HT-135 or HT-200	GALDEN/Fluorinert/DI-EG	GALDEN/Fluorinert	GALDEN/Fluorinert
Compressor	None	None	Yes	Yes	Yes
Dimension	Chiller: H492mm x D460mm x W115mm Controller: H125mm x D564mm x W433mm	Chiller: H492mm x D460mm x W230mm Controller: H125mm x D564mm x W433mm	W:560 x D:910 x H:946mm	W:400 x D:680 x H:780mm	W:920 x D:540 x H:990mm
Powerline Voltage	190-230 VAC,3-phase,4-wire,47-63Hz	190-230 VAC,3-phase,4-wire,47-63Hz	AC200V 3P 50/60Hz	AC208V 3P 50/60Hz	AC208V 3P 50/60Hz
Rated Current	30A	30A	30A	43A	20A
Power consumption	0.3kw/h	0.5kw/h	6kw/h	10kw/h	4kw
Communication	RS485C、232C、Analog DI/0、 Lon Works、	RS485C、232C、Analog DI/0、 Lon Works、	RS485	Serial RS-485	Analog DI/0

Customer's Summary & Specification

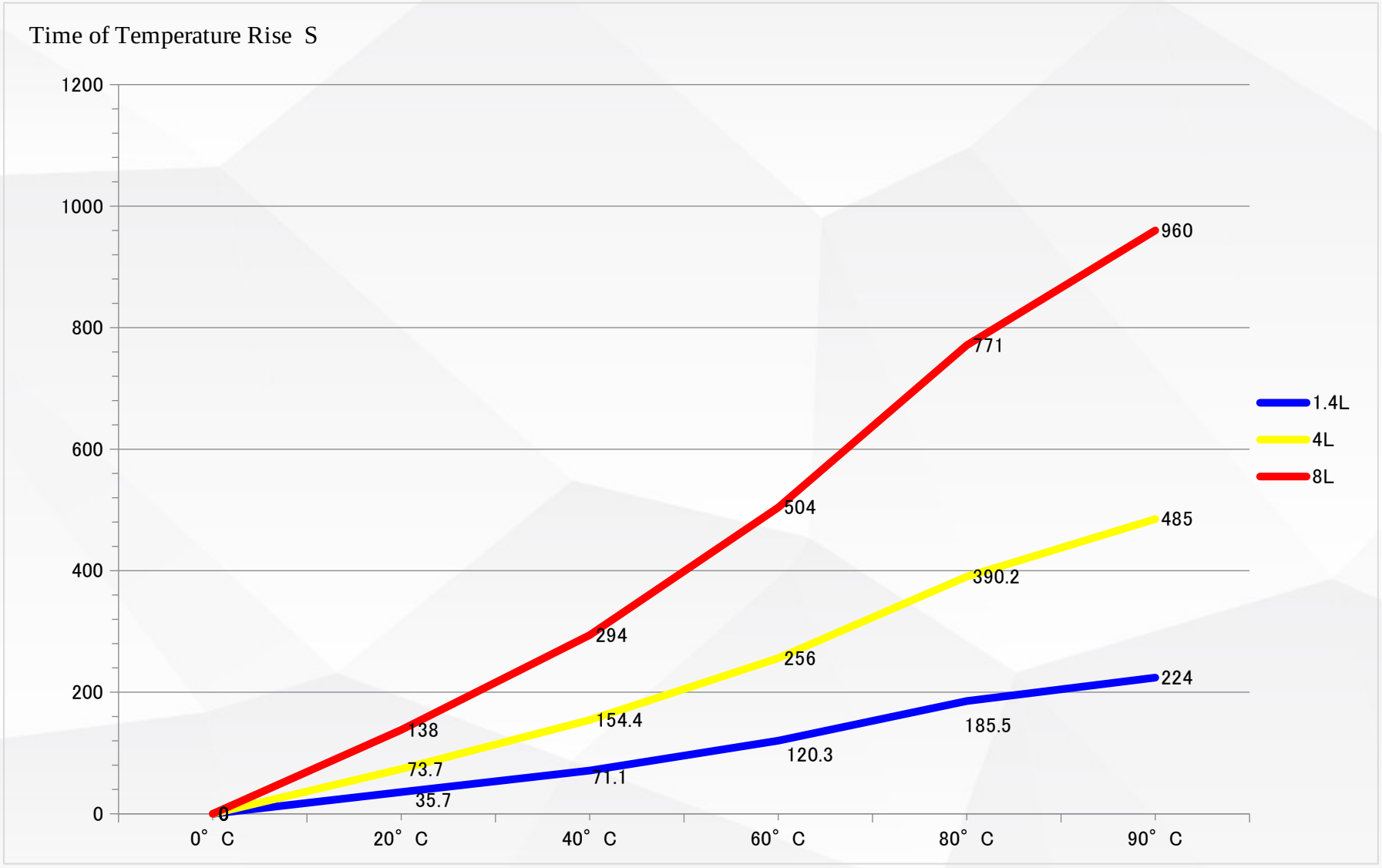
- Better CD control and Reduced First three wafer effect
- NO high global warming potential (GWP) CFCs
- NO associated greases / lubricants & big temperature-anchor reservoir
- NO regular compressor maintenance & constantly running compressor
- NO power-hungry immersion heaters & big AC Pump Motor
- NO big sub-FAB footprint

More Importantly, NO more BIG Electric Bills!

Cooling Capacity vs. Process Temp.

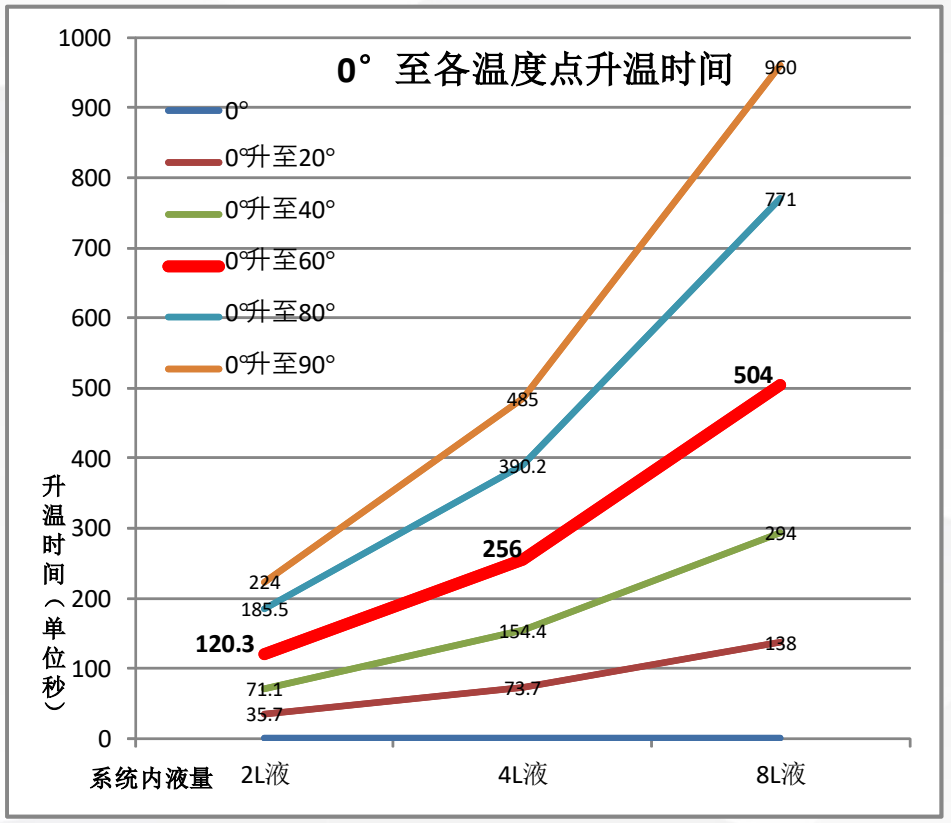


Effect of Coolant Volume (I)

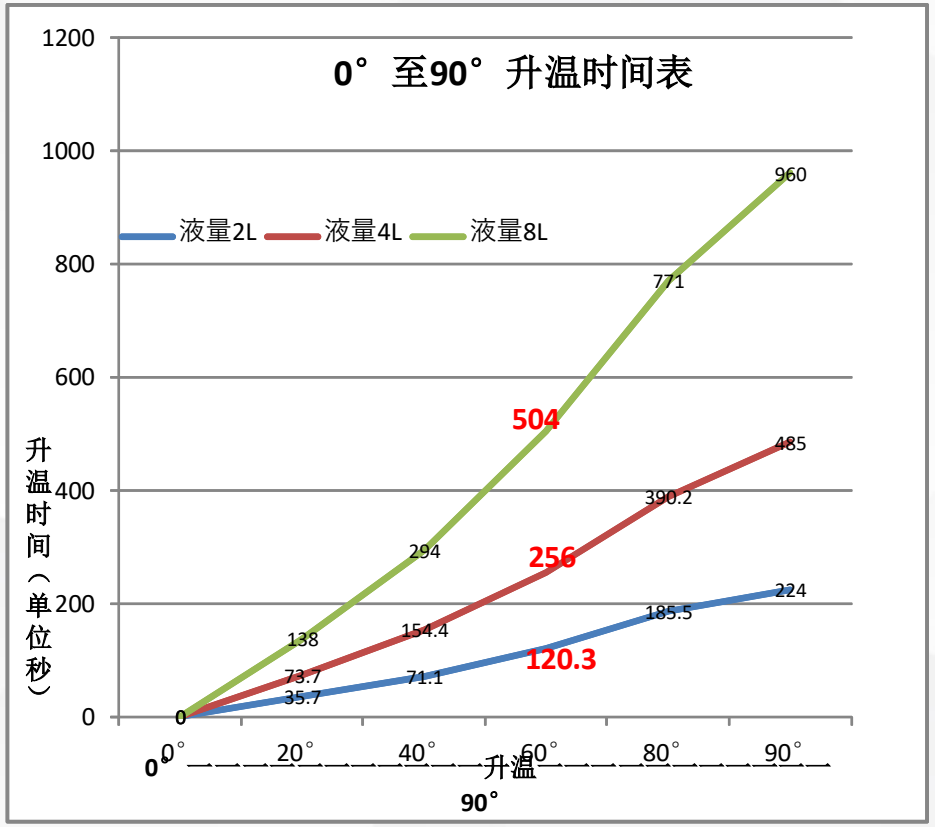


Effect of Coolant Volume (II)

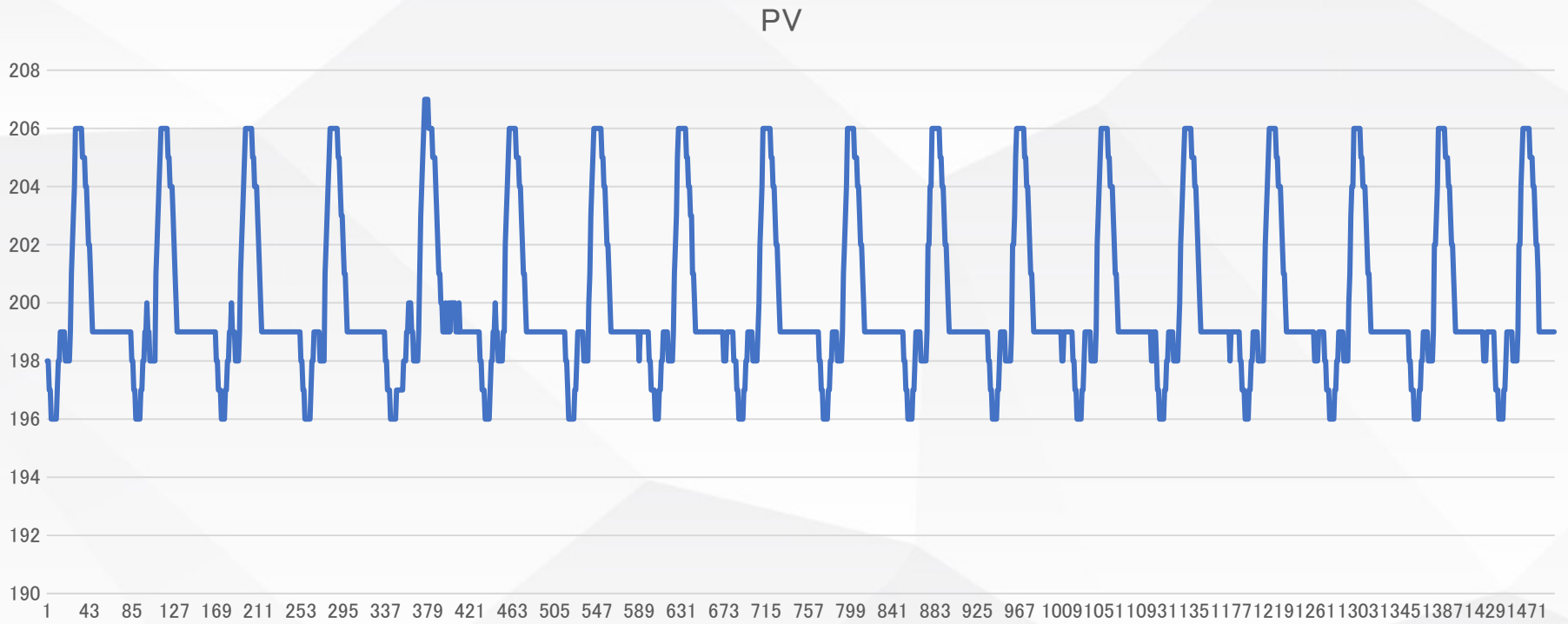
Type A



Type B



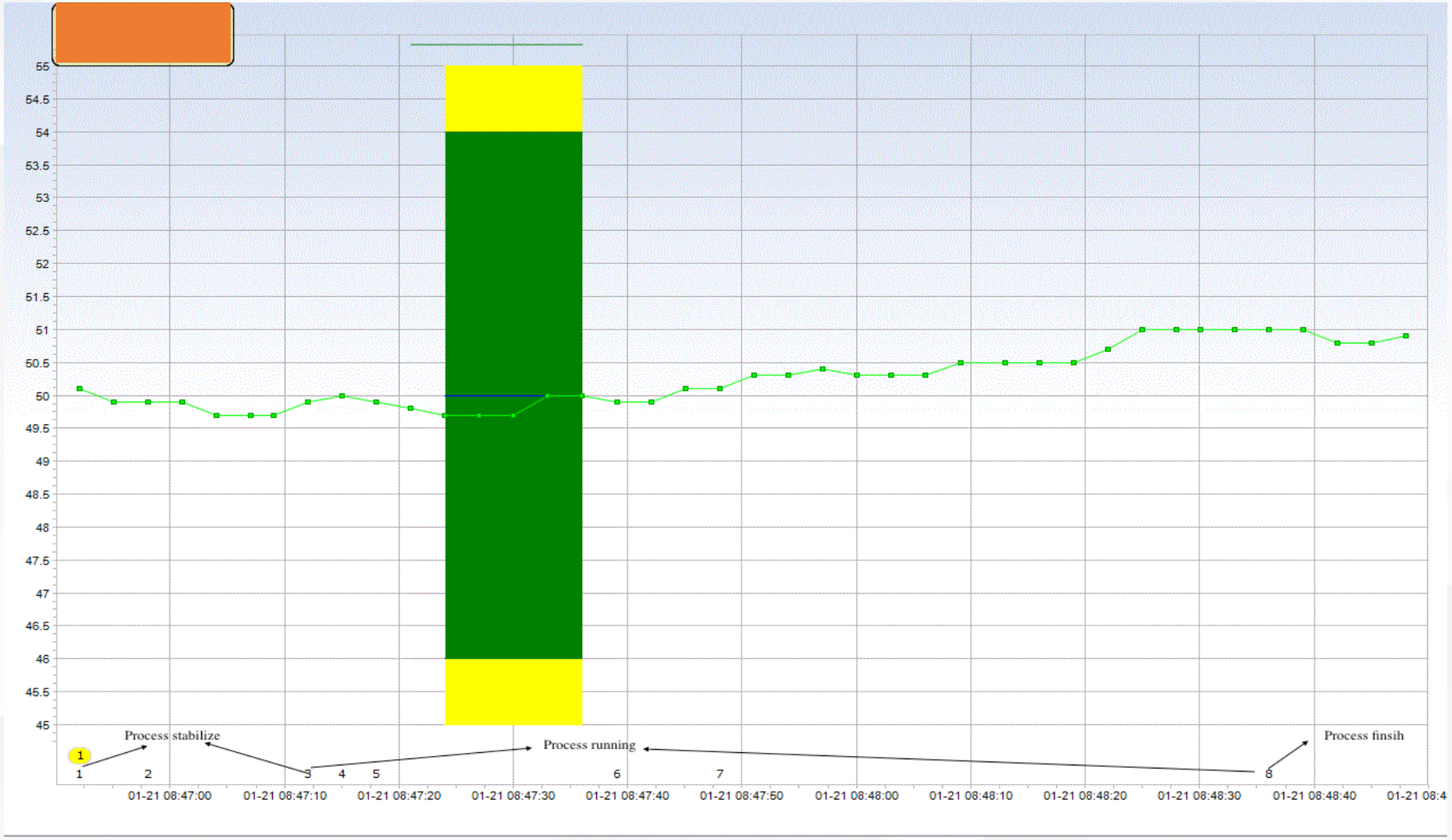
Temp control Accuracy in whole etching process



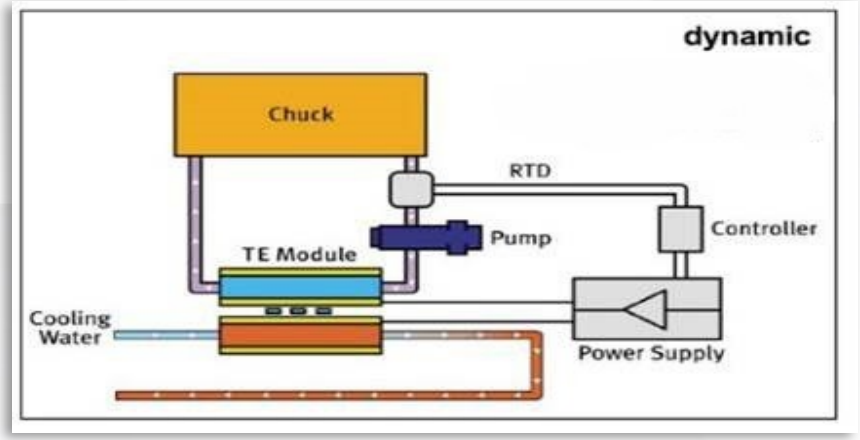
The temperature control profile is the Z6000 chiller at a process of 12“ LAM2300@20 degrees （OXIDE).

The temperature is controlled at ±1 degree throughout the process.

Temp control Accuracy in whole etching process

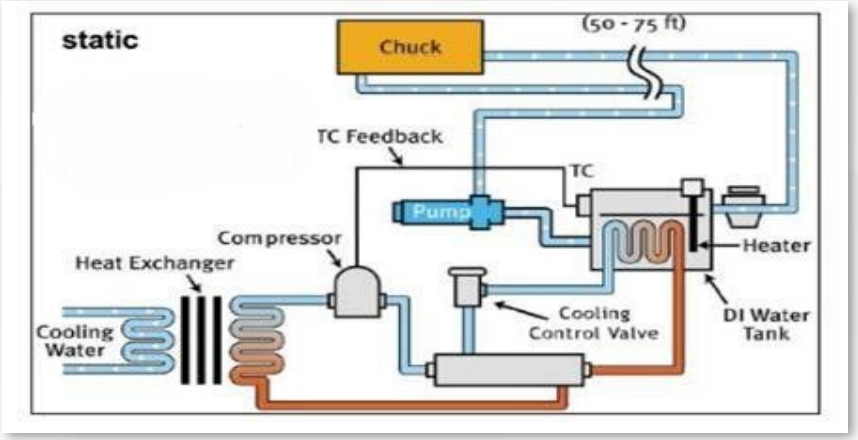


TE Chiller vs. Traditional Static Chiller



● Sensing the temperature of the process fluid returned from the process chamber (wafer chuck) and varying the temperature of the process fluid supplied to the chamber to compensate for changing process conditions.

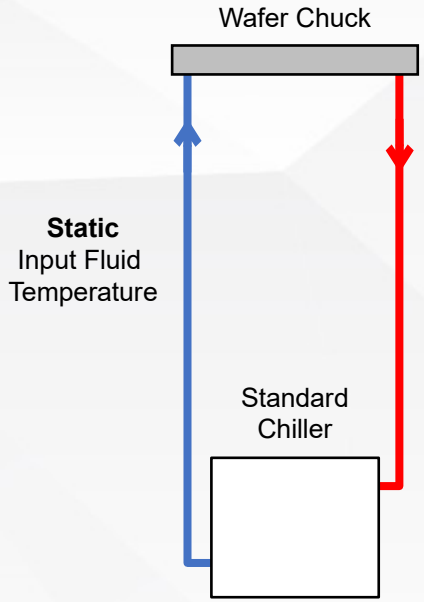
● In real-time,
•Temperature control at the TE
• rapid ramp rates equal greater chamber productivity
• compressor-free TE system consumes ~50% less power
• entire system has one (1) moving part for higher reliability
• use of per fluorinated fluids requires no filtration or highly specialized components
• zero footprint with sub-floor mount
• modular system design results in simplified troubleshooting and fast MTTR

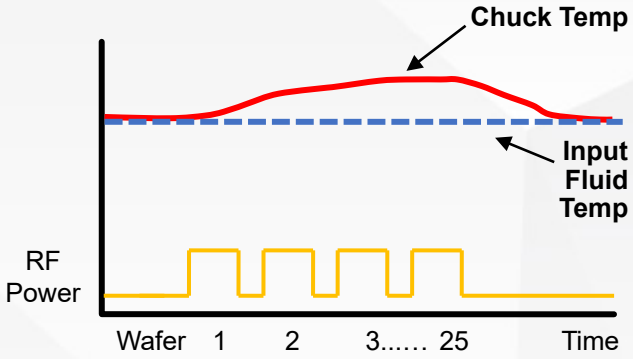


● Maintain the temperature set-point in a very large reservoir by cycling heaters and cooling control valves on & off, thus, consuming about 50% more power than the TE Chiller System.

• large footprint consumes valuable fab tool space
• large reservoir & long process fluid hose length requires ~6X more fluid than a TE chiller system
• static heating/cooling units typically in remote locations increase cost & decrease efficiency
• compressors and large pumps require frequent maintenance & consume 50% more power than TE chiller systems

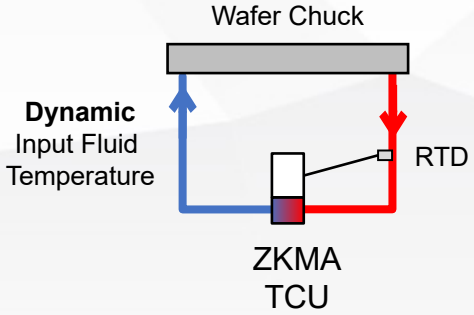
Static vs. Dynamic Temp Control

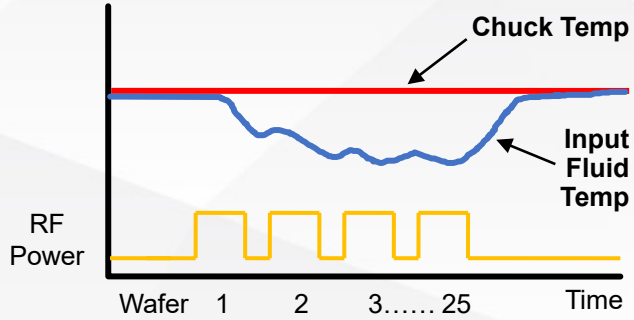




Static Input Fluid Temp
- Large reservoir
- Reservoir temp is constant
- 27 meters from tool
- Slow to heat/cool

= TEMPERATURE DRIFT





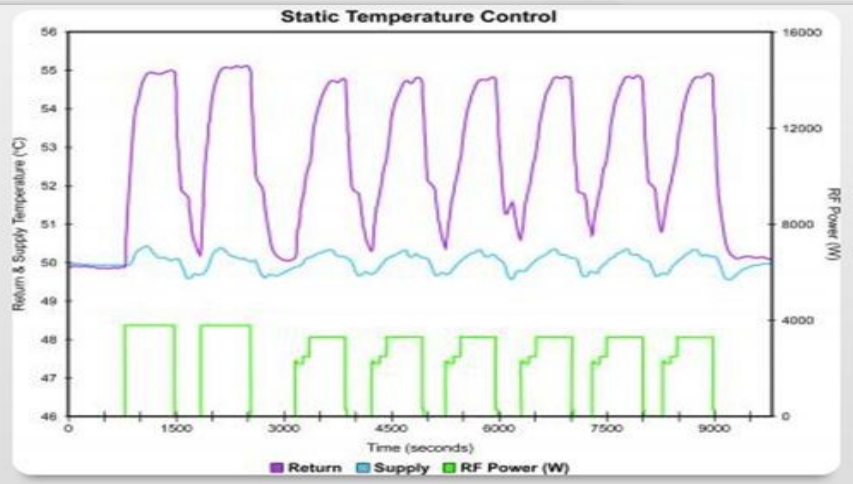
Dynamic Input Fluid Temp
- Small reservoir
- Set point control at return
- Close proximity to tool (2 meters)
- Rapid heat/cool

= UNIFORM CHUCK TEMP

Static vs. Dynamic Temp Control

The fluid temperature profiles below were captured during a production run. This data "snapshot" shows a very significant fluid temperature rise per wafer and includes a baseline temperature rise through-the-lot. The customer was very surprised to see these temperature excursions, considering the OEM qualified chiller was reporting a ~1 °C temperature variance through the entire process!! (shown as fluid supply temperature)

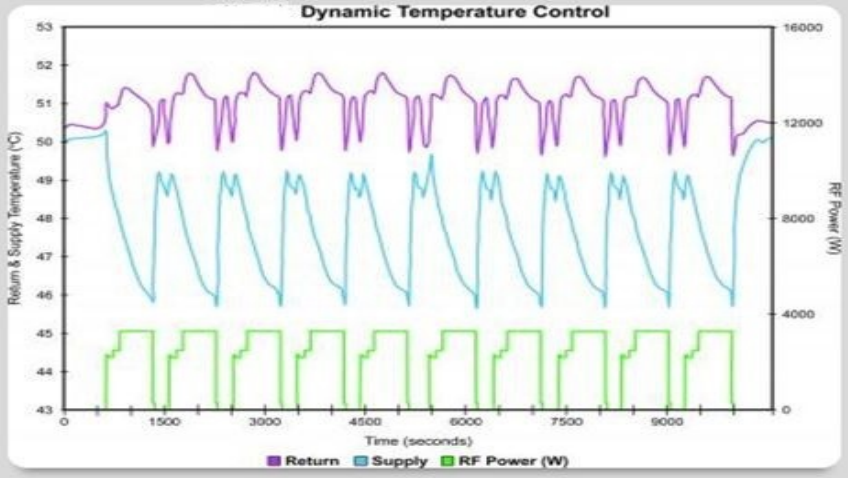
- 2 season wafers due to 1st wafer effect
- cathode temperature varies ~5 °C, per wafer
- baseline temperature time rise through the lot
- only HX reservoir temperature is maintained
- HX does not respond to temperature changes in chamber



AMAT HART 300mm Static

The fluid temperature profiles below were captured during a production run under "identical conditions" as the previous data-set. The most compelling aspects of this comparative data-set are the temperature uniformity and rapid response (time) accomplished under extremely high RF power conditions. This data clearly demonstrates Dynamic Temperature Control. Note how the fluid supply temperature is changed to compensate for the changing process conditions, in real-time...

- uniform temperature control, wafer-to-wafer
- Cathode temperature varies ~1 °C
- no season wafers needed - minimized 1st wafer effect
- no change in baseline temperature
- POU system is synchronized with the process



AMAT HART 300mm Dynamic

ZKMA TE Chiller Application

Applied Materials®					
Chambers	**Platforms**	**Process (Loops)**	**Temp range**	**Typical Temp**	**Module**
ASP(+)	Centura 5200 - Centura 2 & 300mm	Strip (Wall)	20 - 80 °C	60°C	Z-3000
DPS DPS II	Centura 5200 - Centura 2 & 300mm	Si (Cathode)	20 - 60 °C	55°C	Z-3000
DPS DPS II	Centura 5200 - Centura 2 & 300mm	Si (Wall)	20 - 90 °C	80°C	Z-3000
DPS DPS II	Centura 5200 - Centura 2 & 300mm	Metal (Cathode)	20 - 60 °C	45°C	Z-3000
DPS DPS II	Centura 5200 - Centura 2 & 300mm	Metal (Wall)	20 - 90 °C	80°C	Z-3000
DPS DPS II	Centura 5200 - Centura 2 & 300mm	Nitridation (Cathode)	20 - 60 °C	55°C	Z-3000
DPS DPS II	Centura 5200 - Centura 2 & 300mm	Nitridation (Wall)	20 - 90 °C	65°C	Z-3000
eMax eMax(CT)	Centura 5200 - Centura 2 & 300mm	Oxide (Cathode)	0 - 80 °C	20°C	Z-3000, Z-6000
eMax eMax(CT)	Centura 5200 - Centura 2 & 300mm	Oxide (Liner)	20 - 80 °C	40°C	Z-3000
HART(+) HART 3	Centura 300mm	Si-DT (Cathode-Lid)	20 - 80 °C	50 & 75°C	Z-3000, Z-6000
HART(+) HART 3	Centura 300mm	Si-DT (Wall)	20 - 80 °C	60°C	Z-3000
HART(+) HART 3	Centura 300mm	Si-DT (Cathode-In/Out)	20 - 105 °C	80 & 90°C	Z-3000
HART(+) HART 3	Centura 300mm	Si-DT (Wall)	20 - 90 °C	60°C	Z-3000
HeWEB/WxP	P5000 - Centura 5200 - Centura 2	Tungsten (Cathode)	20 - 60 °C	20°C	Z-3000
HeWEB/WxP	P5000 - Centura 5200 - Centura 2	Tungsten (Wall)	20 - 80 °C	60°C	Z-3000
MxP(+) eMxP+	P5000 - Centura 5200 - Centura 2	Si (Cathode)	10 - 60 °C	40°C	Z-3000
MxP(+) eMxP+	P5000 - Centura 5200 - Centura 2	Si (Wall)	20 - 65 °C	60°C	Z-3000
MxP(+) eMxP+	P5000 - Centura 5200 - Centura 2	Metal (Cathode)	10 - 60 °C	40°C	Z-3000
MxP(+) eMxP+	P5000 - Centura 5200 - Centura 2	Metal (Wall)	20 - 90 °C	60°C	Z-3000
MxP(+) eMxP+	P5000 - Centura 5200 - Centura 2	Oxide (Cathode)	0 - 60 °C	20°C	Z-3000
MxP(+) eMxP+	P5000 - Centura 5200 - Centura 2	Oxide (Wall)	20 - 60 °C	40°C	Z-3000
PVD	Endura 5500 - Endura 2 (300mm)	Al • TiN (Platen)	-20 - 95 °C	20°C	Z-3000, Z-6000
Semitool	Raider	B S Clean (Chem Tank)	10 - 50 °C	20°C	Z-3000, Z-6000
Semitool	Raider	B S Clean (IPA Loop)	10 - 50 °C	18°C	Z-3000
Super e	Centura 5200 - Centura 2	Oxide (Cathode)	-20 - 40 °C	15°C	Z-3000, Z-6000
Super e	Centura 5200 - Centura 2	Oxide (Wall)	0 - 60 °C	15°C	Z-3000

ZKMA TE Chiller Application

Lam Research®					
Chambers	**Platforms**	**Process (Loops)**	**Temp range**	**Typical Temp**	**Module**
4400 4400XLe™	Standalone - Alliance	SI (Upper electrode)	10 - 60 °C	30°C	Z-3000
4400 4400XLe™	Standalone - Alliance	SI (Lower electrode)	0 - 40 °C	10°C	Z-3000
4500 4500i 4500XLe™	Standalone - Alliance	Oxide (Upper electrode)	10 - 60 °C	30°C	Z-3000
4500 4500i 4500XLe™	Standalone - Alliance	Oxide (Lower electrode)	-20 - 40 °C	10°C	Z-3000, Z-6000
4700 4700X18™	Standalone - Alliance	Metal (Upper electrode)	10 - 80 °C	40°C	Z-3000
4700 4700X18™	Standalone - Alliance	Metal (Lower electrode)	0 - 60 °C	20°C	Z-3000
DSiE	Standalone - Alliance	SI (MEMS) (Lower electrode)	0 - 60 °C	20°C	Z-3000
Exelan ® (HPT/Flex)	Alliance - 2300 - 2300 Domino	Oxide (Upper electrode)	0 - 40 °C	30°C	Z-3000, Z-6000
Exelan ® (HPT/Flex)	Alliance - 2300 - 2300 Domino	Oxide (Lower electrode)	-10 - 60 °C	20°C	Z-3000, Z-6000
Kiyo / Kiyo 45	2300 - 2300 Domino	SI (Lower electrode)	-20 - 70 °C	20°C	Z-3000, Z-6000
TCP® 9100	Alliance	Oxide (Lower electrode)	0 - 40 °C	10°C	Z-3000, Z-6000
TCP® 9400	Standalone - Alliance	Si (Lower electrode)	0 - 60 °C	20°C	Z-3000
TCP® 9600	Standalone - Alliance	Metal (Lower electrode)	20 - 70 °C	60°C	Z-3000
Versys (& tunable)	2300 - 2300 Domino	SI (Lower electrode)	10 - 80 °C	20°C	Z-3000
Versys (& tunable)	2300 - 2300 Domino	Metal (Lower electrode)	20 - 80 °C	60°C	Z-3000
Mattson					
Chambers	**Platforms**	**Process (Loops)**	**Temp range**	**Typical Temp**	**Module**
ICPsm	Aspen II (200mm)	Strip Poly (Platen)	40 - 80 °C	60°C	Z-3000
Alpine	Aspen III (300mm-BE)	Strip Poly (Platen)	20 - 80 °C	25°C	Z-3000
eHighlands	Aspen III (300mm-FE)	Strip Poly (Platen)	20 - 80 °C	25°C	Z-3000
Novellus					
Chambers	**Platforms**	**Process (Loops)**	**Temp range**	**Typical Temp**	**Module**
Iridia	PEP (200mm)	Surface Prep (Platen)	20 - 90 °C	70°C	Z-3000
Sierra	Sierra (300mm)	Surface Prep (Platen)	20 - 80 °C	60°C	Z-3000

ZKMA TE Chiller Application

TEL™					
Chambers	**Platforms**	**Process (Loops)**	**Temp range**	**Typical Temp**	**Module**
DRM	Unity® II(e) - Unity® M(e) -TELIUS (SP)	Oxide (Bottom electrode)	-20 - 70 °C	40°C	Z-3000, Z-6000
DRM	Unity® II(e) - Unity® M(e) -TELIUS (SP)	DT (Bottom electrode)	20 - 105 °C	90°C	Z-3000
SCCM	Unity® II(e) - Unity® M(e) -TELIUS (SP)	Poly (Top electrode)	20 - 105 °C	60°C	Z-3000
SCCM	Unity® II(e) - Unity® M(e) -TELIUS (SP)	Poly (Bottom electrode)	-20 - 80 °C	20°C	Z-3000, Z-6000
SCCM	Unity® II(e) - Unity® M(e) -TELIUS (SP)	Oxide (Top electrode)	20 - 105 °C	60°C	Z-3000
SCCM	Unity® II(e) - Unity® M(e) -TELIUS (SP)	Oxide (Bottom electrode)	-20 - 60 °C	10°C	Z-3000, Z-6000
JIN	TELIUS (SP) - Tactras	Poly (Bottom electrode)	-20 - 80 °C	20°C	Z-3000, Z-6000
JIN	TELIUS (SP) - Tactras	Poly (Top electrode)	20 - 105 °C	60°C	Z-3000
JIN	TELIUS (SP) - Tactras	Oxide (Bottom electrode)	-20 - 60 °C	10°C	Z-3000, Z-6000
JIN	TELIUS (SP) - Tactras	Oxide (Top electrode)	20 - 105 °C	60°C	Z-3000
Vigus	Tactras	Oxide (Bottom electrode)	-20 - 60 °C	10°C	Z-3000
Vigus	Tactras	Oxide (Top electrode)	20 - 90 °C	30°C	Z-3000, Z-6000

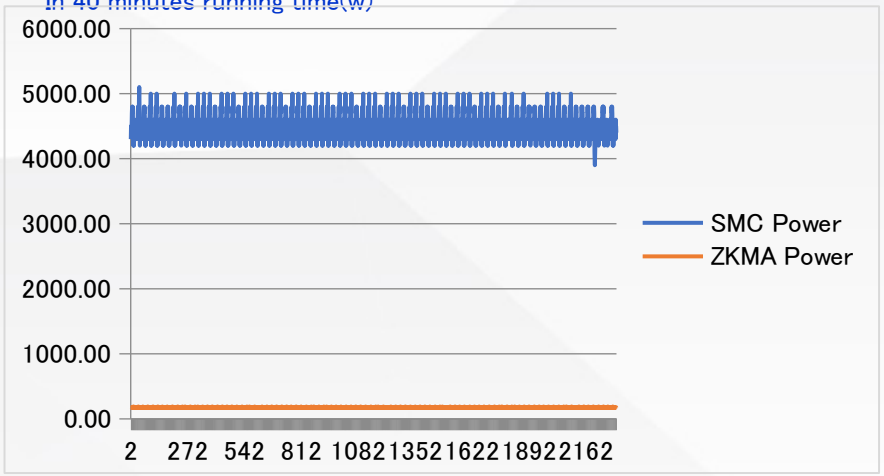
ZKMA TE Chiller Installation Base

Site	Chillers	Applications
TSES 中芯凸版，上海	20+	TEL TELIUS DRM
SSMC 台积电，新加坡	10+	AMAT DPS Metal
TSMC 台积电，上海松江	20+	LAM Alliance – 9400
SILAN 士兰微，杭州，厦门	70+	LAM 2300, LAM 9600, HITACHI, AMAT DPS Metal
HHGRACE 华虹宏力 FAB3，上海	80+	AMAT DPS Metal/Poly/eMax/Super E/, LAM 9400/9600/Dsie, TEL DRM
SMIC 中芯国际，上海 S1	1	LAM 9600
INNOSCIENCE 英诺赛科，苏州吴江	70+	AMAT DPS Metal/Poly/eMa/xSuper E, MAHA
INFIONEON 英飞凌，马来西亚	10+	Lam 9400/9600
PSK 比思科，韩国	4	ECOLITE 3000

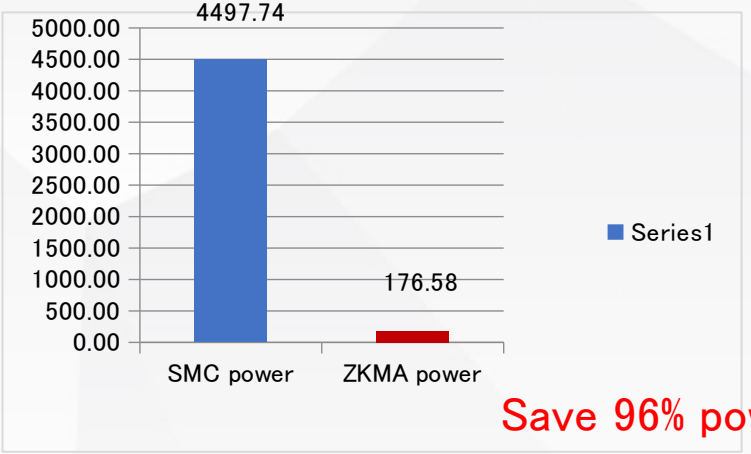
Power Measurement-AMAT DPS+ METAL (A Customer) TEL SCCM (C Customer)

AMAT DPS+ METAL@65℃,SMC HX2000 Vs. ZKMA Z-3000

In 40 minutes running time(w)



SMC HX2000 Vs. ZKMA Z-3000 Average power consumption(W)

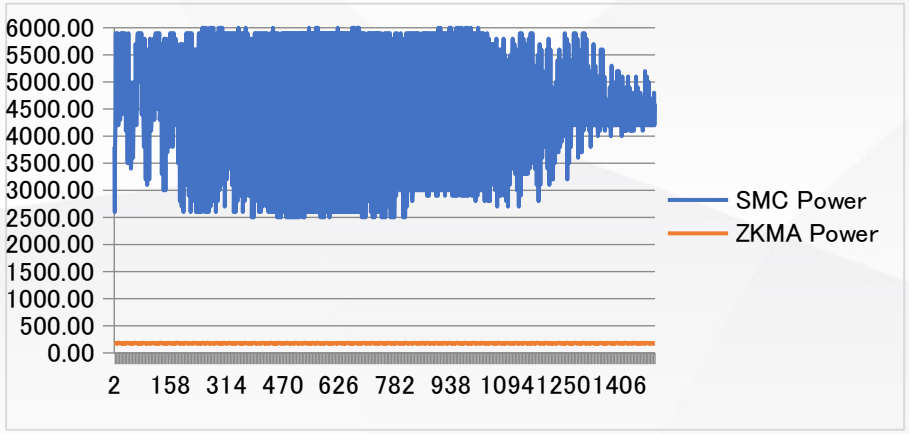


Save 96% power.

TEL SCCM@60℃ SMC INR-499-203-X038 Vs. ZKMA Z-3000

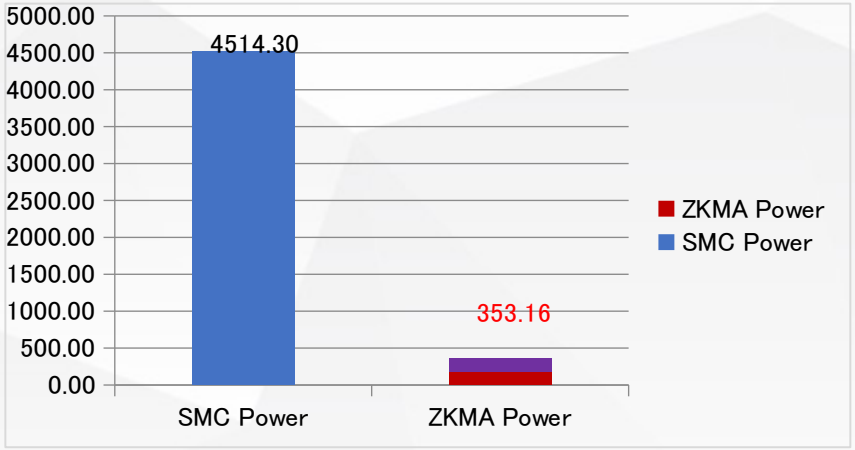
in 50 minutes running time

SMC is dual channel types chiller, and so the ZKMA power consumption is 176.58*2=353.16(W)

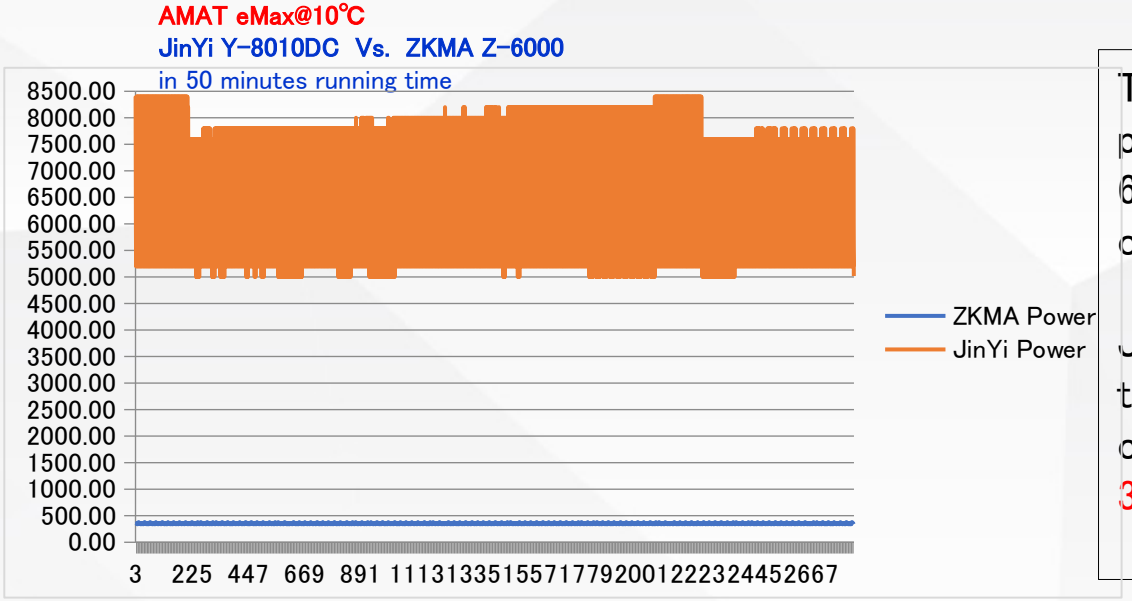


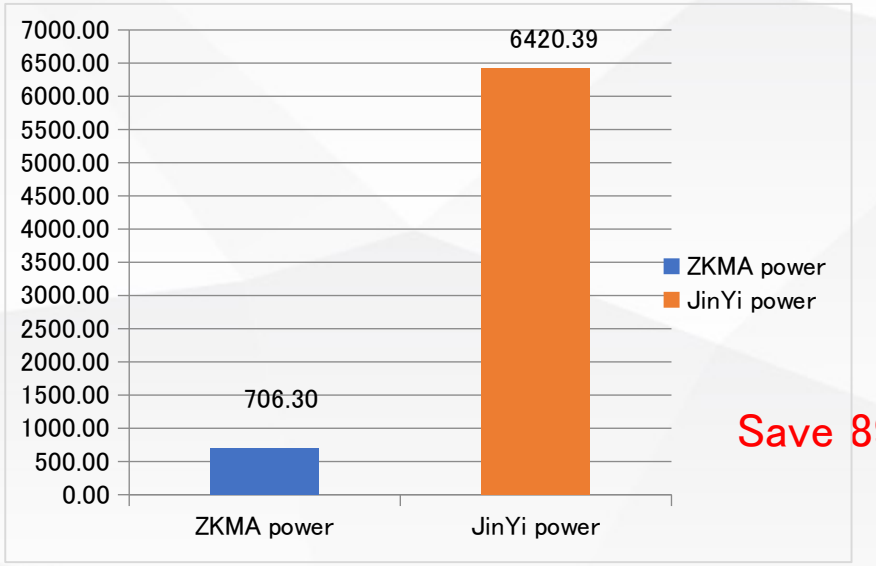
SMC INR-499-203-X038 Vs. ZKMA Z-3000 Average power consumption(W)

Save 92% power.



Power Measurement-AMAT eMax (S Customer)





Two charts at left side shows power consumption of ZKMA Z-6000 chiller and JinYi Y-8010DC chiller.

JinYi Y-8010DC is dual channel types chiller, so 2*Z-6000 power consumption is:
353.15.58*2=706.3(W)

Save 89% power.

Cost Saving on LAM2300 (COC)

Cost Saving on LAM 2300		MARUYAMA HCL 202-LD		ZKMA Z-6000			
Fluorinert usage during installation		8		1			Gallon
Fluorinert cost/gallon	$	500	$	500			USD/Gallon
Fluorinert cost	$	4,000	$	500			USD
Fluorinert cost (TWD)	CNY	26,000	CNY	3,250			CNY
Estimated chiller electrical consumption		8		1.8			kw-hr
Electricity price	CNY	1.0	CNY	1.0			CNY/kwh
annual electricity cost	CNY	70,080	CNY	15,768			CNY
2-year electricity cost	CNY	140,160	CNY	31,536			CNY
5-year electricity cost	CNY	350,400	CNY	78,840			CNY
Typical annual Fluorinert usage		6		1			Gallon
Fluorinert cost (USD)	$	3,000	$	500			USD
Fluorinert cost (TWD)	CNY	19,500	CNY	3,250			CNY
2-year fluorinert cost	CNY	39,000	CNY	6,500			CNY
5-year fluorinert cost	CNY	97,500	CNY	16,250			CNY
Typical annual maintenance cost (USD)	$	8,000	$	5,000			USD
Typical annual maintenance cost(TWD)	CNY	52,000	CNY	32,500			CNY
2-year maintenance cost	CNY	104,000	CNY	65,000			CNY
5-year maintenance cost	CNY	260,000	CNY	162,500			CNY
1st year cost-new	CNY	167,580	CNY	54,768	cost-saving	CNY	112,812
2-year total cost	CNY	309,160	CNY	106,286	cost-saving	CNY	202,874
5-year total cost	CNY	733,900	CNY	260,840	cost-saving	CNY	473,060
* Calculation based on:		1 USD					6.5 CNY
MARUYAMA HCL 202-LD	x 1						
ZKMA Chiller Group							
*Z-6000	x 2						

ROI Research on LAM2300

ROI Research on LAM 2300		MARUYAMA HCL 202-LD		ZKMA Z-6000	
Chiller Price (USD)	$	40,000	$	46,000	USD
Chiller Price (CNY)	CNY	260,000	CNY	299,000	CNY
Fluorinert usage during installation		8		1	Gallon
Fluorinert cost/gallon	$	500	$	500	USD/Gallon
Fluorinert cost	$	4,000	$	500	USD
Fluorinert cost (CNY)	CNY	26,000	CNY	3,250	CNY
Captial and fluid startup cost	CNY	286,000	CNY	302,250	CNY
Estimated chiller electrical consumption		8		1.8	kw-hr
Electricity price	CNY	1.0	CNY	1.0	CNY/kwh
annual electricity cost	CNY	70,080	CNY	15,768	CNY
2-year electricity cost	CNY	140,160	CNY	31,536	CNY
5-year electricity cost	CNY	350,400	CNY	78,840	CNY
Typical annual Fluorinert usage		6		1	Gallon
Fluorinert cost (USD)	$	3,000	$	500	USD
Fluorinert cost (CNY)	CNY	19,500	CNY	3,250	CNY
2-year fluorinert cost	CNY	39,000	CNY	6,500	CNY
5-year fluorinert cost	CNY	97,500	CNY	16,250	CNY
Typical annual maintenance cost (USD)	$	8,000	$	5,000	USD
Typical annual maintenance cost(CNY)	CNY	52,000	CNY	32,500	CNY
2-year maintenance cost	CNY	104,000	CNY	65,000	CNY
5-year maintenance cost	CNY	260,000	CNY	162,500	CNY
1st year cost-new	CNY	167,580	CNY	54,768	
2-year total cost	CNY	309,160	CNY	106,286	
5-year total cost	CNY	733,900	CNY	260,840	
ROI- purchasing ZKMA Chiller				**289.26%**	
ROI- purchasing ZKMA Chiller in 2nd year				**520.19%**	
ROI- purchasing ZKMA Chiller in 5th year				**1212.97%**	

* Calculation based on:	1				6.5
	USD				CNY
MARUYAMA HCL 202-LD	x 1				
ZKMA Chiller Group					
*Z-6000	x 2				

Thank You

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