Five-constant standard definition

The third :

On System Air Conditioning Human thermal comfort

1) Human thermal comfort ; 2) Comfort class evaluation;
3) Air conditioning scheme of Five-constant system (9 scenarios)

Menred Group / National HVAC Association Council unit
Member of the National HVAC and Purification Equipment Standardization Technical Committee (SAC / TC143)
Technical Standards for Near-Zero Energy Consumption Buildings, Technical Standards for Zero Carbon Buildings, and Energy Saving Design Standards for Public Buildings
Heat Recovery Fresh Air Unit, Fan Coel Unit, Household Fresh Air Dehumidifier Integrated Heat Pump Type Fresh Air Environment Control Machine and Technical Regulations for Radiation Heating and Cooling
And other 27 national standard drafting units
National high-tech enterprise / specialization, special and new · little giant / green factory / beautiful factory
Partner of State Key Laboratory of Future Construction / undertake sub-project of national 13th Five-Year Key Research and Development Plan

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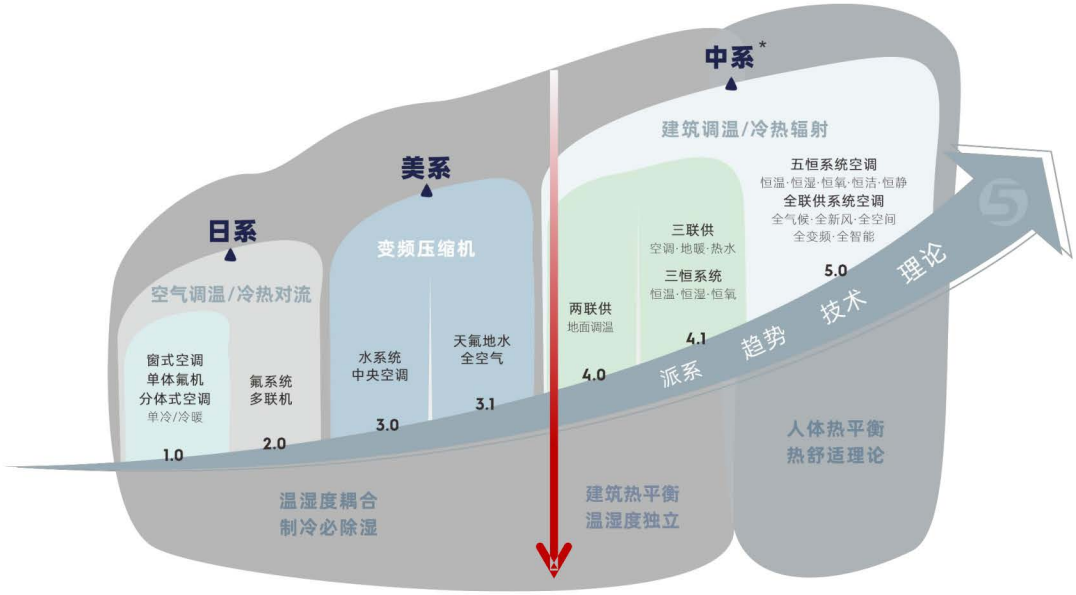


In 2015,

Change the lane and overtake

The evolution history of the new air conditioning

Biological analogy:

Mainstream monkeys go blind, with only some non-mainstream (innovative) monkey "collateral variation" that continues to evolve into modern Homo sapiens.

Air conditioning technology evolution, from 1.0 to 5.0 is not a substitution relationship, but coexistence .

market trend :

From Japanese, American to Chinese, is the " product to the system " upgrade

Equipment brand is becoming less important, and the service brand is becoming more important .

Changing lanes and overtaking :

More than 90% of the world's air conditioners are made in China *. With technology integration and innovation and business model transformation, Chinese air conditioning will accelerate the realization of lane change and overtaking.

Traditional air conditioning to system air conditioning, technology upgrading and commercial transformation.

① From cooling with dehumidification, to temperature and humidity independent control;

② From the fluorine machine to the water machine, change the water temperature without blow ing cold air (silent and sterile);

③ From convection air conditioning (indirect heat transfer / temperature control) to radiation air conditioning (direct heat transfer / field temperature control);

④ From the intermittent operation to save , to the continuous operation to save energy ;

⑤ From the building environment thermal comfort to heat dissipation balance, the human body thermal comfort.

⑥ From door-to-door service to remote service, real-time cloud operation and maintenance "value service".

Redefin e "new air conditioning" overview

Redo the air conditioning with the "system theory."

System theory is the study of the structure, characteristics, behavior, dynamics, principles, laws and the correlation between systems,
And establish the theoretical system of mathematical expression.
The basic idea of systems theory is to treat the object of research and treatment as a whole.

System air conditioning ≠ traditional air conditioning

Traditional air conditioning is temperature conditioning, not air conditioning; system air conditioning is not only air conditioning.

On the same AIO digital HVAC cloud platform,
integrate (air conditioning, floor heating, fresh air, humidity adjustment, domestic hot water, automatic control, lighting and other subsystems,
the relationship between waterways, wind road, air road and circuit)
as a whole of the big system.

In order to grasp the whole system, to achieve the optimal goal.

The whole system air conditioning is greater than the sum of the parts;
because of:

Building carbon neutrality with the human body thermal comfort, the construction of the theoretical system.

1) Human thermal comfort theory

What is comfort?

Comfortable refers to maintaining a calm and peaceful life in the environment, maintaining physical and mental health, without trouble, disease, anxiety; give people a feeling of ease and comfort.

GB / T 50785-2012 "Evaluation Standard for Indoor Heat and wet Environment in Civil Buildings": Thermal comfort is the subjective satisfaction evaluation of people to the surrounding hot and wet environment, which stipulates the heat and wet environment grade I , II and III, and the corresponding population satisfaction is 90%, 75% and less than 75% respectively.


UDC

中华人民共和国国家标准 GB

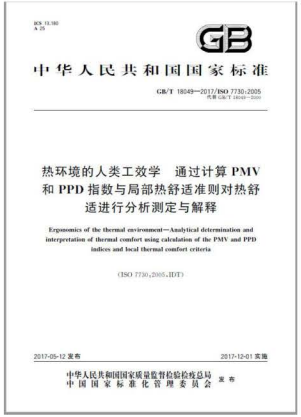
P GB/T 50785-2012

民用建筑室内热湿环境评价标准

Evaluation standard for indoor thermal environment in civil buildings

2012-05-28 发布 2012-10-01 实施

中华人民共和国住房和城乡建设部
中华人民共和国国家质量监督检验检疫总局 联合发布


GB

中华人民共和国国家标准

GB/T 18049—2017/ISO 7730:2005

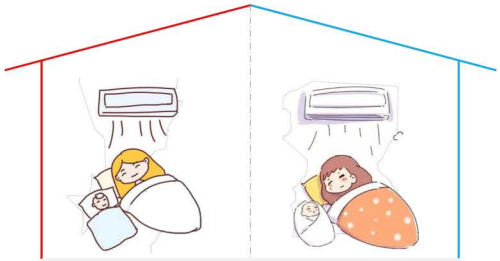
热环境的人类工效学 通过计算 PMV 和 PPD 指数与局部热舒适准则对热舒适进行分析测定与解释

Ergonomics of the thermal environment—Analytical determination and interpretation of thermal comfort using calculation of the PMV and PPD indices and local thermal comfort criteria

(ISO 7730:2005,IDT)

2017-09-12 发布 2017-12-01 实施

中华人民共和国国家质量监督检验检疫总局
中国国家标准化管理委员会 发布



Thermal discomfort in life:

why? Under same temperature, Covering a thin quilt feels hot in summer,

It feels cold to cover a thick quilt in winter.

The vertical temperature difference is too large

Cause of " dizzy head "

Winter by the window side or exterior wall "cold air sense"

The ground temperature is too low to cause "frozen feet"

Scalding sensation caused by overheated electric floor heating

why?

The air in the basement is warm, but staying too long will have a cold feeling .

Understand human thermal comfort

The body senses hot and cold and its regulation

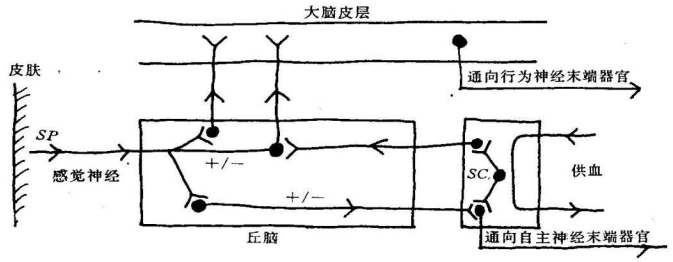
Metabolic heat generation is the energy source of the human body, maintaining the body temperature at about 36.5℃. Rectal temperature = human brain temperature = liver temperature = right atrium + 0.6℃ = esophageal temperature + 0.6℃ = oral temperature + 0.4℃

People feel cold and cold is perceived by cells on the body surface, feeling faster to cold and slower to heat (more sensitive to cold).

The regulation process of the human body to the thermal environment: Environment stimulates → the thermal sensory nerve → brain (thalamus) → regulate the neuromodulation → response.

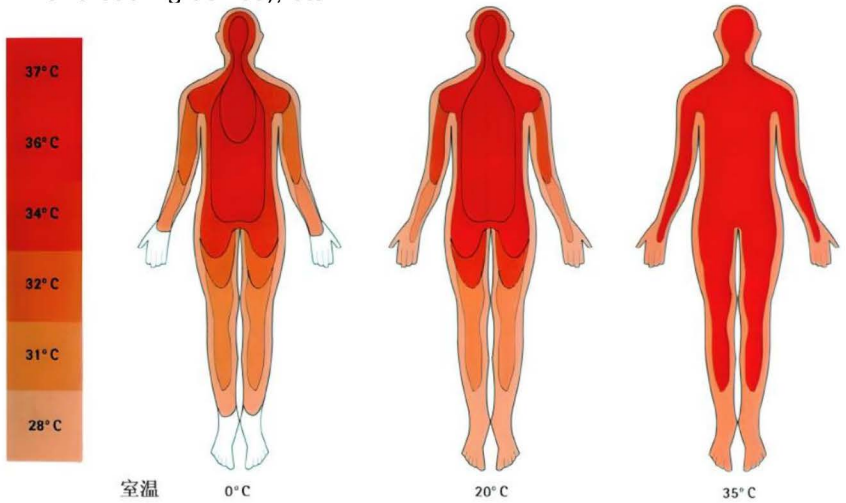
Physiological regulation : when body temperature increases, blood circulation and heart rate increase; blood vessels on the skin expand and sweat evaporates. When the body temperature decreases, the skin surface blood vessels contract to prevent heat loss.

Behavior adjustment : dressing, window ventilation, air conditioning (heating and cooling device), etc.



6 key factors that affect human thermal balance

Note: Air temperature should not be used to evaluate human comfort.



Literature source: Tongyue Energy Saving Technology

Understand human thermal comfort

M= W+ Qrad + Qconv + Qexha

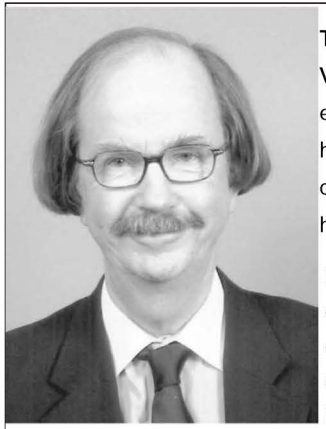
M=human metabolism;

W=human external work consumption ;

Qrad=radiation heat exchange;

Qconv=convection heat exchange;

Qexha =Breathing, sweat, evaporation of heat, etc.



The Danish University of Science and Technology P.O. Fanger Van gel, professor of "human thermal comfort" theory : the establishment of human thermal balance equation, that the human body metabolism of heat production and external heat dissipation to reach the balance (equal or offset), this time the human body feels the most comfortable.

PMV thermal comfort model is Fanger in the 1970s, through a large number of climate chamber experimental research, after a series of theoretical analysis, the comprehensive body thermal comfortable four physical variables (air temperature, air flow velocity , environmental surface average radiation temperature, relative humidity) and two artificial variables (clothes thermal resistance, human activity), put forward the ability to predict thermal comfort PMV index. This indicator represents the heat sensation of the vast majority of people in the same environment.

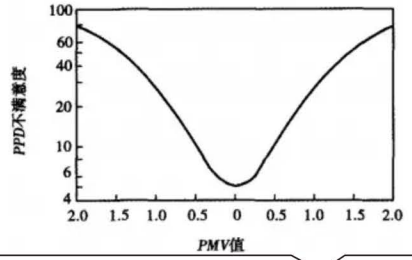
通过式(1)～式(4)计算 PMV：

$$PMV=(0.303e^{-0.036M}+0.028)\left\{\begin{array}{l}(M-W)-3.05\times10^{-3}\times[5\,733-6.99(M-W)-P_a]-\\0.42\times[(M-W)-58.15]-1.7\times10^{-5}M(5\,867-P_a)-\\0.001\,4M(34-t_a)-3.96\times10^{-8}f_{cl}\times\\[(t_{cl}+273)^4-(\bar{t}_r+273)^4]-f_{cl}h_c(t_{cl}-t_a)\end{array}\right\} \quad (1)$$

$$t_{cl}=35.7-0.028(M-W)-I_{cl}\{3.96\times10^{-8}f_{cl}\times[(t_{cl}+273)^4-(\bar{t}_r+273)^4]+f_{cl}h_c(t_{cl}-t_a)\} \quad (2)$$

$$h_c=\begin{cases}2.38\,|t_{cl}-t_a|^{0.25} & \text{当 } 2.38\,|t_{cl}-t_a|^{0.25}>12.1\sqrt{v_{ar}}\\12.1\sqrt{v_{ar}} & \text{当 } 2.38\,|t_{cl}-t_a|^{0.25}<12.1\sqrt{v_{ar}}\end{cases} \quad (3)$$

$$f_{cl}=\begin{cases}1.00+1.290I_{cl} & \text{当 } I_{cl}\leqslant0.078\ \text{m}^2\cdot\text{K/W}\\1.05+0.645I_{cl} & \text{当 } I_{cl}>0.078\ \text{m}^2\cdot\text{K/W}\end{cases} \quad (4)$$

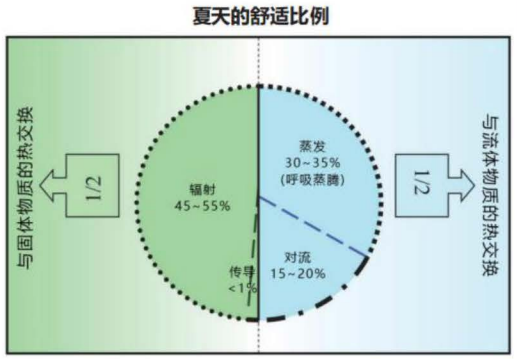


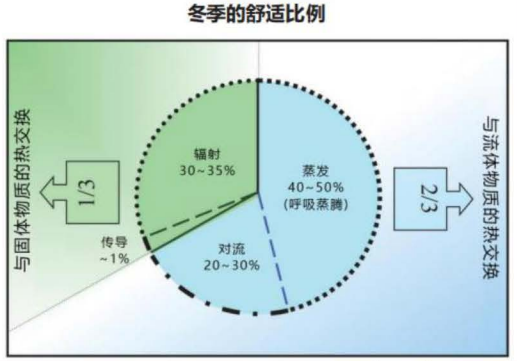
From the perspective of heat balance between human body and environmental heat transfer, rather than from the perspective of building heat load.

Literature source: VIVALDI

Understand human thermal comfort

Italian scholar
ROBERTO MESSANA
Studying the energy relationship between the human body and the environment " theor y, runs through nearly 40 years of work in the academic and entrepreneurial





To really achieve thermal comfort, human thermal balance is a necessary condition, heat dissipation ratio is a sufficient condition.

Literature source:
VIVALDI

This page is from: Radiative architecture by Roberto-Mesana

Fanger equation with Carrier method, the presence of 2 missing...

The formation of the thermal comfort equation (from chapter 3), and then is transformed into the international standard UNI EN ISO 7730. The heat sensation experienced by different subjects was assessed and quantified by the index of "predicted average votes" (PMV): -3 (cold) <-2 (cool) <-1 (slightly cool) <0 moderate> + 1 (slightly warm)> + 2 (warm)> + 3 (hot).

参数	案例 1	案例 2
空气温度	19 ℃	25 ℃
辐射温度	60 ℃	23 ℃
相对湿度	15%	55%
气流速度	> 2 米/秒	0.05 米/秒
新陈代谢活动	1.15 met	1.15 met
衣服	0.6 clo	0.6 clo
PMV	0 !	0

Failure under specific conditions:

Case 1: The tin house in the desert sun has a strong convection air conditioning.

Case 2: Houses in the Alps, sunny in summer without air conditioning.

2 cases with the same PMV value of 0 (moderate),

The predicted dissatisfaction percentage PPD is not higher than 5%.

However, even though they are equal in terms of thermal balance, the human perceived comfort is certainly different.

Therefore, the PMV index can only be understood as an indicator of cold, hot or moderate thermal condition; but not represented the perceived quality of cold, hot or balanced; this is the missing one.

It's like emphasizing that one person eats too much, too little or in moderation;

Instead of studying the ingredients of the food.

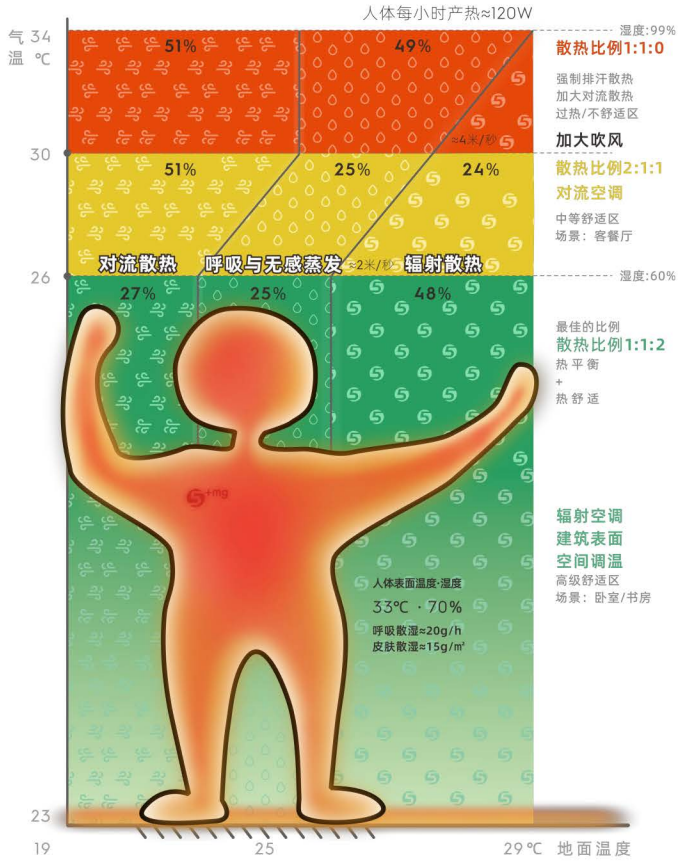
Mr.Carrier invented the first set of air conditioning system in 1902, the application object is paper, with temperature and humidity as the design parameters; the purpose is to reduce the humidity of the printing factory, to improve the printing process. **But "people aren't made of paper".**

The surface temperature (including clothing) of the human body is between 24.2℃ and 36.3℃, so the radiation wavelength is between 9.723 and 9.342 microns, equivalent to the frequency between 3.0813 and 3.2113 Hz. In fact, the root cause of the problem is right here. When applying technology to improve the comfort of the human body, it is not considered that the human body is a warm body with an emission coefficient almost equal to the "black body" (the surface emission and absorption radiation rate is 100%). The human body can lose a lot of heat through infrared radiation and is sensitive to both surface and air temperatures; this is missing two.

Summary: Two missing facts, the "thermal comfort assessment and heat load calculation" of radiation air conditioning lead to incorrect cognition and design."Do things with a correct understanding" and correct:

1) Thermal comfort ≠ thermal balance: should be based on a reasonable proportion of human heat dissipation; 2) Human body ≠ paper: human body surface is almost "black body", about 50% of the heat is lost through radiation; to the traditional convection air conditioning system, there is load overload and operation waste.

Three heat dissipation ratio and heat balance and thermal comfort



热平衡≠热舒适，热平衡并不意味着热舒适，
恰当的散热比例，才能达到热平衡＝热舒适。

Heat dissipation and heat balance (about 120W)

Human is always a heat sink .

Proper heat dissipation ratio of 1:1:2 can maintain a relatively constant body temperature

That is: human thermal comfort under the heat dissipation balance stat e.

Note: Co nvection heat dissipation 27% + respiration and evaporation 25%, radiation heat dissipation accounts for 48% is a quantitative analysis of heat ratio in summer; it turns 1:1:1 in winter

When human body's heat production and heat dissipation are equal , it reaches heat balance.

Human body in the normal metabolic process, continuous ly produce and dissipate heat .

The balance between heat dissipation and heat production is needed to maintain a relatively constant body temperature,

Ensure that all organs and tissues of the body perform normal physiological functions.

System air-conditioning design strategy:

Radiation heat transfer (visible heat)

+

convection heat transfer (latent heat)

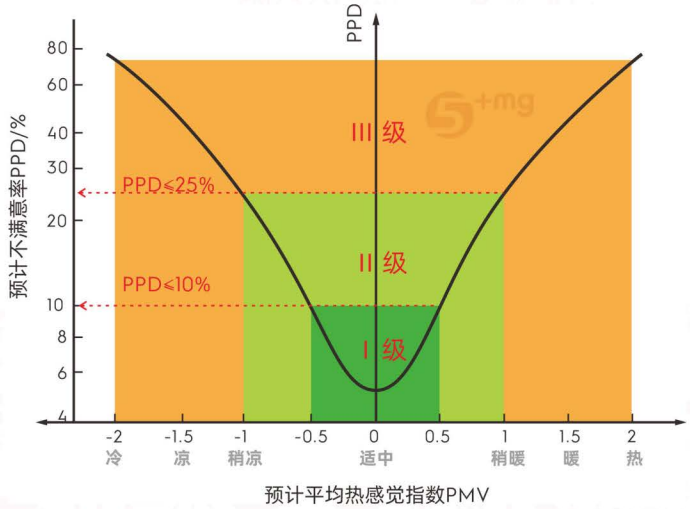
The overall thermal sensation comfort grade evaluation method (PMV / PPD) Domestic compared to international

The PMV (Predicted Mean Vote) index was determined by the Danish professor P.O. Fanger , proposed in the 1970s. PMV is an indicator used to quantify the body's subjective perception of the thermal environment:

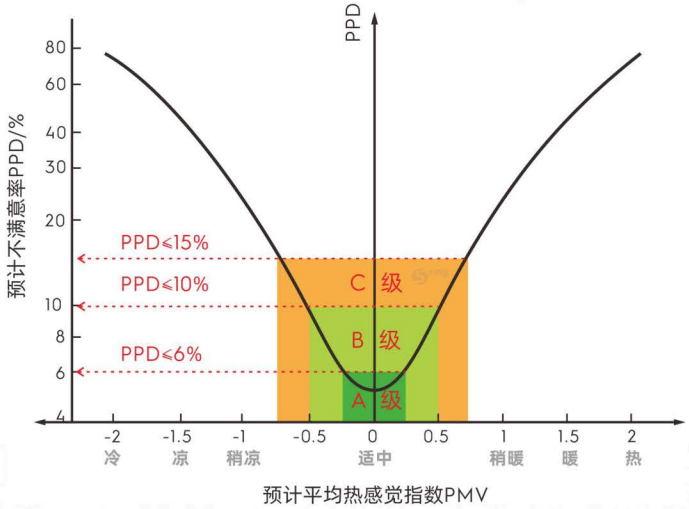
PMV value 7 grades: -3 (cold) <-2 (cool) <-1 (slightly cool) <0 moderate> + 1 (slightly warm)> + 2 (warm)> + 3 (hot).

PPD (Predicted Percentage of Dissatisfied) is a quantitative measure of people's comfort with the thermal environment. It evaluates the projected percentage of dissatisfied people based on thermal comfort under indoor ambient conditions.

Higher PPD values indicate that more people may feel dissatisfied, while lower PPD values indicate higher comfort.



GB/T50785



ISO7730

Point of view: GB / T is too broad, ISO does not adapt

2) Comfort grade evaluation

New energy housing Research Institute EEH ©Five constant standard definition

Overall thermal sensation dissatisfaction rate and comfort rating:

ClassA⁺ comfort: PPD≤10%

Class A comfort: PPD≤15%

Class B comfort: PPD≤20%

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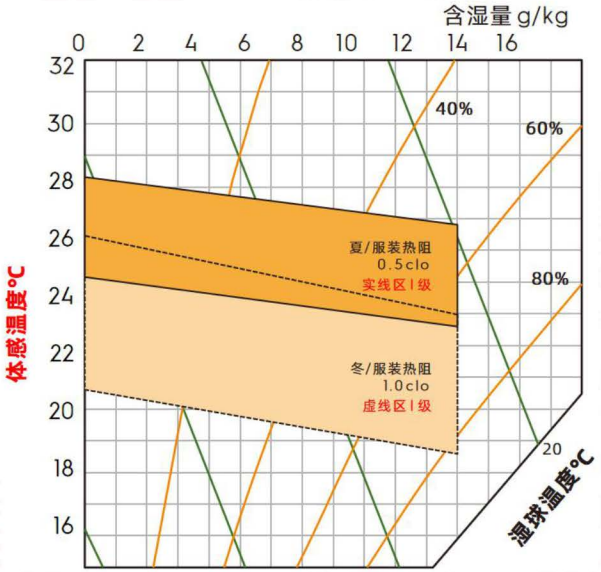
GB / T50785 recommended thermal comfort



What is the "somatosensory temperature"?

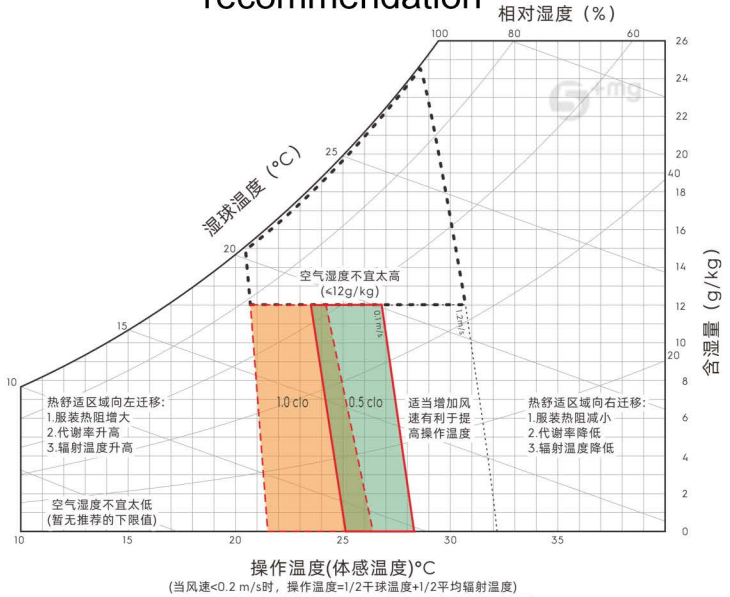
Air temperature and radiation temperature (field temperature), the combined effect of these two temperature on the human body, called, somatosensory temperature; also known as "operating temperature".

Experience assessment:

When the indoor airflow is less than 0.2 m / s, the humidity is 30~50%, the temperature difference between air temperature and field temperature is less than 4℃, the somatosensory temperature is approximately equal to the average of the two.as below :

Somatic sensing temperature =(air temperature + field temperature) 2

ASHRAE 55 Thermal comfort recommendation



The American Association of Building HVAC Engineers:

80% acceptance for thermal comfort areas in typical indoor environments, The overall thermal comfort (PPD) dissatisfaction rate is 10%, and the local thermal comfort (PD) dissatisfaction rate is 10%

For typical indoor environments:

Personnel sitting metabolic rate (1.1m et), wind speed ≤ 0.2m / s;

Clothing heat resistance:

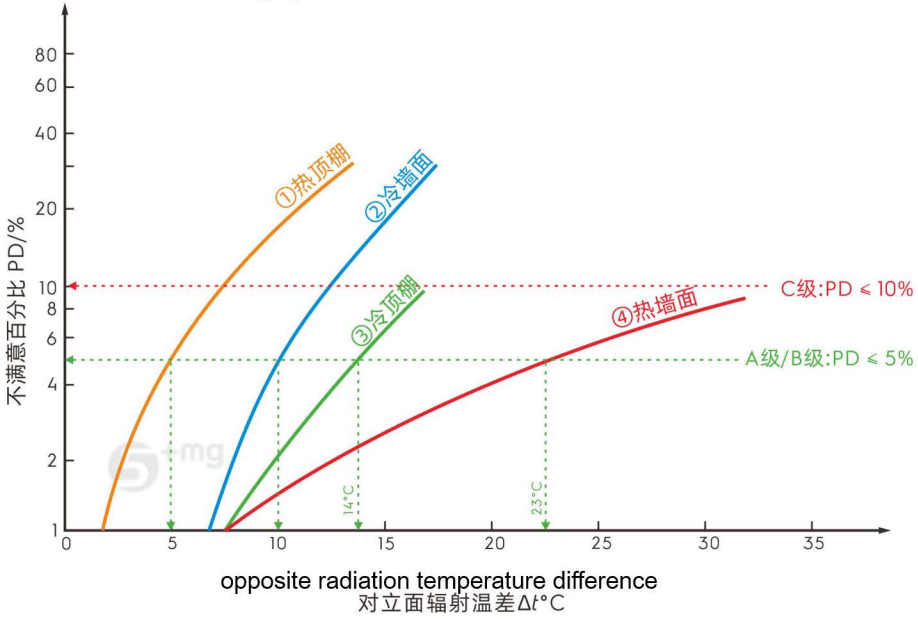
0.5 clo in summer or 1.0 clo in winter

ISO7730 "Local discomfort", PD index

Local dissatisfaction rate of "building temperature regulation", thermal comfort level division:

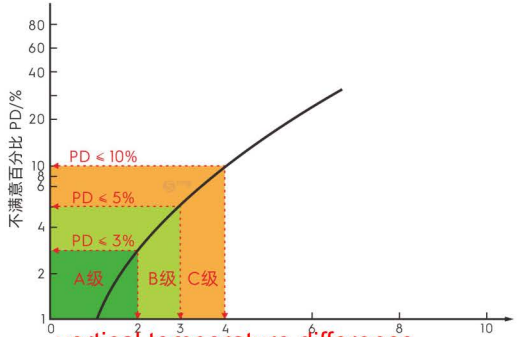
There is radiation temperature difference between the opposite surface : "roof to floor, wall to window , and wall to wall", and the surface temperature difference is called "asymmetric radiation temperature" , collectively called "opposite radiation temperature difference" in this article .

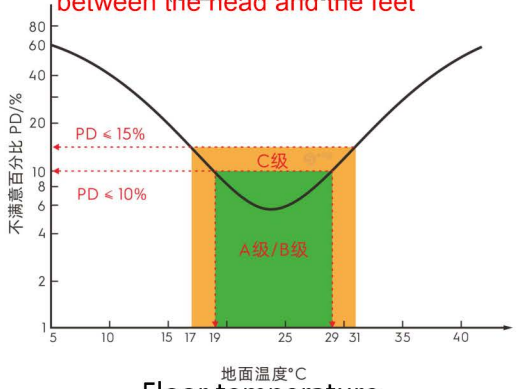
- The human body is particularly sensitive to the opposite radiation temperature difference generated by the hot ceiling or cold wall (windows).
- Cold ceiling: the temperature difference between roof and floor ≤ 14℃, the dissatisfaction rate ≤ 5%, and the local comfort level is A.
- As shown in the following figure:



PMV and PPD are used to indicate the overall heat sensation, but the dissatisfaction is likely caused by local discomfort; the most common reason:

The vertical temperature difference between the head and the feet is too large, and the ground is too hot or too cold.





Thermal feeling comfort level and design index

The international standard I S O 7730 classifies the thermal comfort environment into three grades: A, B and C, and all indicators of each type should be met at the same time.

Thermal comfort grade PPD / PMV / DR / PD evaluation index

heat comfort grade	Overall thermal feeling		Local thermal discomfort			
	discontent rate PPD %	thermal sensation index number PMV	A sense of wind index number DR/%	Dissatisfaction rate: PD /%		
				Vertical temperature difference	Hot and cold ground	Radiation temperature difference between the opposite sides
A	< 6	-0.2<PMV<+0.2	< 10	< 3	< 10	< 5
B	<10	-0.5<PMV<+0.5	< 20	< 5	< 10	< 5
C	<15	-0.7<PMV<+0.7	< 30	< 10	< 15	<10

Example of local indicators of the thermal comfort level

heat comfort grade	Between the head and the foot [a] Vertical temperature difference of Δ℃	Ground-level temperature range is ℃	The opposite side radiation temperature difference is Δ℃			
			heated ceiling	Cold wall	Cold ceiling	Hot metope
A	< 2	19~29	< 5	< 10	< 14	< 23
B	< 3	19~29	< 5	< 10	< 14	< 23
C	< 4	17~31	< 7	< 13	< 18	< 35

[a] Vertical temperature difference refers to the temperature difference between 0.1m and 1.1m above the ground level

Example design guidelines for typical buildings of the thermal comfort class

Construction space type	activity metabolic rate (W/m²)	Thermal comfort grade	Body-sensing temperature or operating temperature of ℃		Maximum average wind speed [a] (m/s)	
			Summer (cooling)	Winter season (heating)	Summer (cooling)	Winter season (heating)
Office / conference room Classroom / restaurant	70	A	24.5 ± 1.0	22.0 ± 1.0	0.12	0.10
		B	24.5 ± 1.5	22.0 ± 2.0	0.19	0.16
		C	24.5 ± 2.5	22.0 ± 3 .0	0.24	0.21 [b]
nursery school	81	A	23.5 ± 1.0	20.0 ± 1.0	0.11	0.10[b]
		B	23.5 ± 2.0	22.0 ± 2.5	0.18	0.15[b]
		C	23.5 ± 2.5	22.0 ± 3.5	0.23	0.19[b]
bazaar	93	A	23.0 ± 1.0	19.0 ± 1.5	0.16	0.13[b]
		B	23.0 ± 2.0	19.0 ± 3.0	0.20	0.15[b]
		C	23.0 ± 3.0	19.0 ± 4.0	0.23	0.18[b]

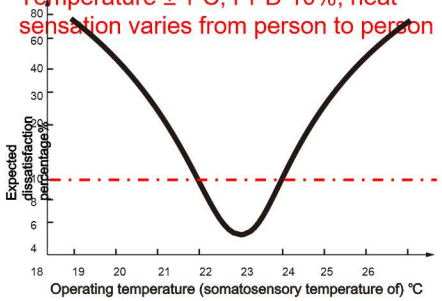
pour a: The maximum average wind speed is based on 40% of the turbulence intensity and air temperature equal to the operating temperature with 6.2 and the vertical air temperature difference between head and foot. For the relative humidity in summer and winter were 60% and 40%, respectively. For winter and summer, the lower temperatures in the interval are used to determine the maximum mean wind speed. pourb : **Below the 20℃ limit, see the vertical air temperature difference between head and foot.**

Note: Office summer cooling, class A summer deviation value is slightly larger. ± 1℃, class B ± 1.5℃, grade C ± 2.5℃; heating

(See GB / T 50785-2012 Evaluation Standard for Indoor Heat and Wet Environment for Civil Buildings)

Relationship between temperature fluctuations and dissatisfaction rates

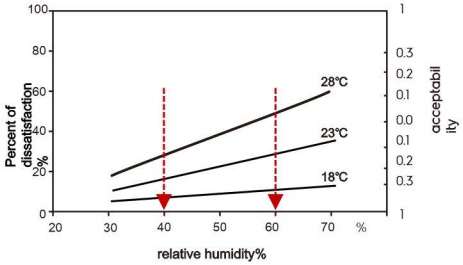
Temperature ± 1℃, PPD 10%; heat sensation varies from person to person



Corresponding PMV = 0, sitting human body (1.2met,1.0clo)

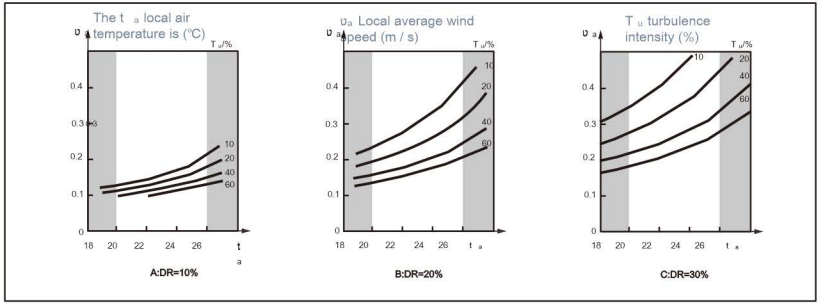
Relationship between relative humidity and dissatisfaction rate

At the same temperature, when RH increases, and the satisfaction rate decreases.



Blow feeling index: local discomfort caused by blowing

Maximum permissible mean wind speed as a function of local air temperature and turbulent intensity



PD limit and comfort level

(New Energy Housing Research Institute EEH ©

Definition of Five-constant standard

comfort grade	Room temperature fluctuations Limits ℃	Head and foot vertical difference in temperature Δ℃	Floor temperature regulation limit: ℃	Ceiling panel cooling limit	
				Heat exchange ability (W/ m²)	surface temperature (℃)
A⁺	≤1.0	≤2	20~28	77	≥19
A	≤1.5	≤3	19~29	99	≥17
B	≤2.0	≤4	19~29	99	≥17

Note：

1) Vertical temperature difference refers to the temperature difference between 0.1m and 1.1m above the ground.

2) Comfort grade A ⁺ is suitable for high standard energy saving buildings, it is recommended to improve the envelope (heat insulation and shading).

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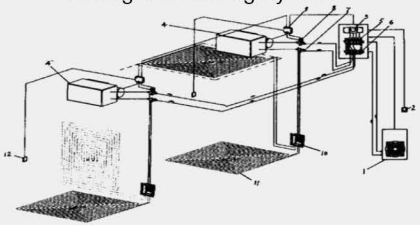
3) Air-conditioning scheme of Five-constant system (9 scenarios)

System air conditioning, ten years of witness

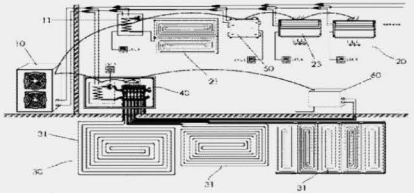
2012

Invention patent in 2012
Authorization number: CN102538142B
Integrated Radiation and Air Conditioning Heating and Heating System



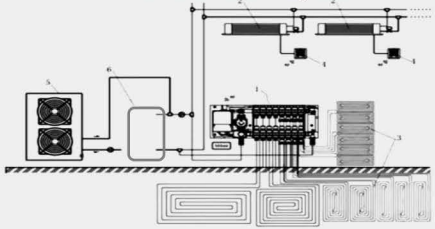
2015

The 2015 utility model patent
Authorization number:
CN204648744U
The Indoor Environment Systems



2020

The 2020 utility model patent
Authorization number:
CN213395567U
An All-in-one System



Two-in-one , t hree-in-one , Three constant , fluorine on top and water underground, Five-constant system

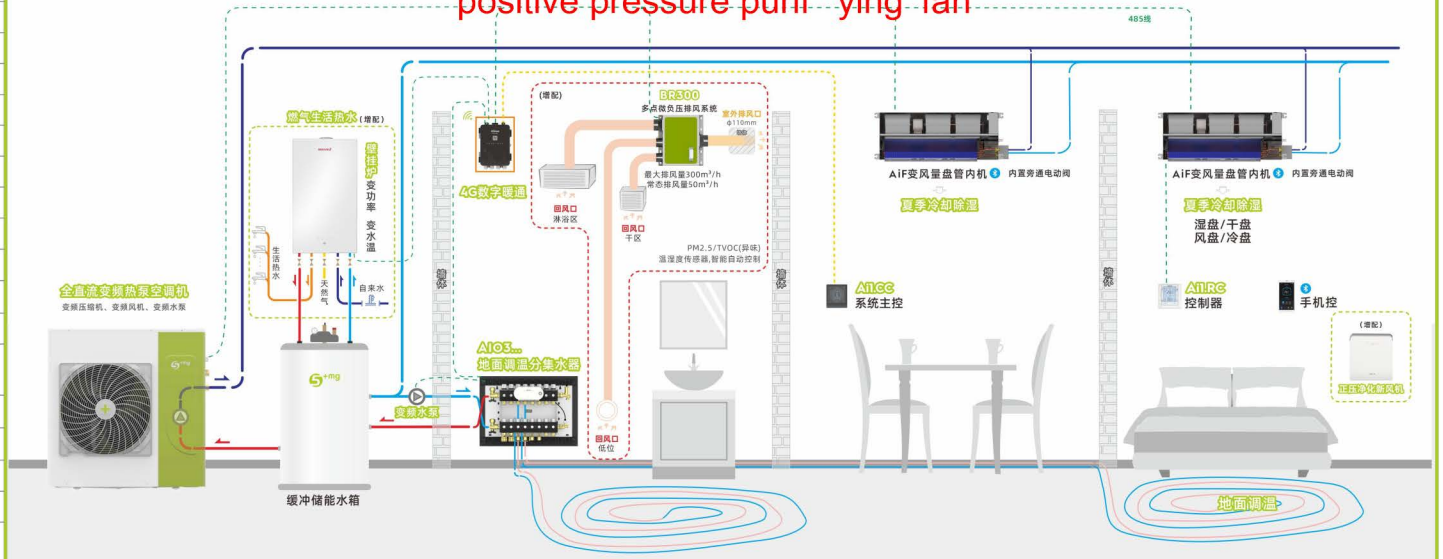
Addition to be bigger, subtraction to be stronger, a bright future but a long way to go .

One APP / one system

Smart Internet of things	APP/ cellphone
Digital HVAC	Cloud operation and maintenance
Open the window to prevent knot dew	not applicable
FCU	To spread heat or dehumidification
Radiant panel	not applicable
The ground temperature	Warm feet in winter
Ventilation selection	Can add the negative pressure exhaust air
rate of ventilation	not applicable
technical strategy	Summer FCUdehumidification
constant temperatu	20-26 ± 2.0℃, with a vertical temperature difference of 4.0℃
constant humidity	35-65% or 12g / kg
Constant oxygen	Can add the bedroom positive pressure purification new fan
Constant pire	Can add negative pressure exhaust or waste fresh air system
Constant quiet	Low silent fan 35dB (A)
predict PPD	≤20%
Unit price according to the floor area	RMB 750 / ㎡
Applicable area advice	100㎡
Suggestions for internal thermal insulation renovation	50mm polyurethane foam or EPS / EPP molded board for thermal insulation
Living hot water	Gas hot water wall hanging furnace can be added (Full premixed level 1 energy saving)
Water purification three-piece set proposal	Front filter (after the water meter) + ultrafiltration water purifier (Kitchen) + RO pure water machine (direct drinking)
toilet Electric floor heating	RMB 3500 / unit below 10 square meters, Each additional 1 square meter is charged by 300 yuan
Negative pressure exhaust air increase	Toilet or chess room multi-point micro negative pressure exhaust (RMB 2,999 / set)
Local space addition	Bedroom positive pressure purification new fan / kitchen positive pressure Air repair / underground space dehumidifier fresh air air conditioning

Three modes: FCUcooling and dehumidification, floor heating (foot feeling warm), automatic constant temperature (all devices works simultaneously)

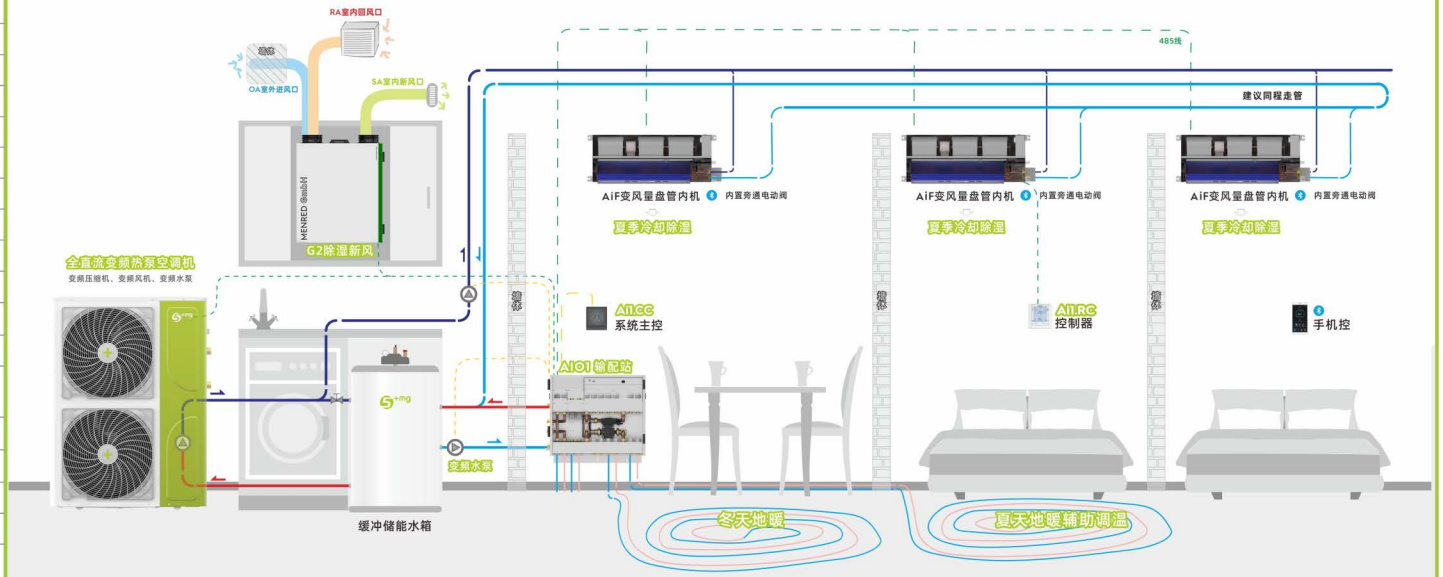
Additional：multi-point negative pressure exhaust system, wall-mounted positive pressure purifying fan



Well1 Five-constant system air conditioning	Owner's name:	contact way:	examine	Merchant signature:
	Green design:		proofread	
item information:	Power configuration:		affirm	

G2 dehumidifier (built-in compressor / inner circulation) + FCU cooling and dehumidification

water distribution	AIO 1
	Secondary change water temperature
Smart Internet of things	APP/ cellphone
Digital HVAC	Cloud operation and maintenance
Open the window to prevent knot dew	not applicable
FCU	To spread heat or dehumidification
Radiant panel	not applicable
The ground temperature	19~29℃
Ventilation selection	G2 dehumidifier new fan
rate of ventilation	0.6 times / hour
technical strategy	Summer FCUdehumidification | four seasons dehumidification fresh air
constant temperature	20-26 ± 1.5℃, with a vertical temperature difference of 3.0℃
constant humidity	40-60% or 11g / kg
Constant oxygen	CO 2:700ppm, formaldehyde: 0.07mg / m³
Constant pure	Who standard: zero pollution PM2.525 ug / m³
Constant quiet	Low silent fan 35dB (A)
predict PPD	≤15%
Unit price according to the floor area	RMB 950/ ㎡
Applicable area advice	150㎡
Suggestions for internal thermal insulation renovation	50mm polyurethane foam or EPS / EPP molded board for thermal insulation
Living hot water	Gas hot water wall hanging furnace can be added (Full premixed level 1 energy saving)
Water purification three-piece set proposal	Front filter (after the water meter) + ultrafiltration water purifier (Kitchen) + RO pure water machine (direct drinking)
toilet Electric floor heating with	RMB 3500 / unit below 10 square meters, Each additional 1 square meter is charged by 300 yuan
Negative pressure exhaust air increase	Toilet or chess room multi-point micro negative pressure exhaust (RMB 2,999 / set)
Local space addition	Bedroom positive pressure purification new fan / kitchen positive pressure Air repair / underground space dehumidifier fresh air air conditioning



Well2 Five-constant system air conditioning

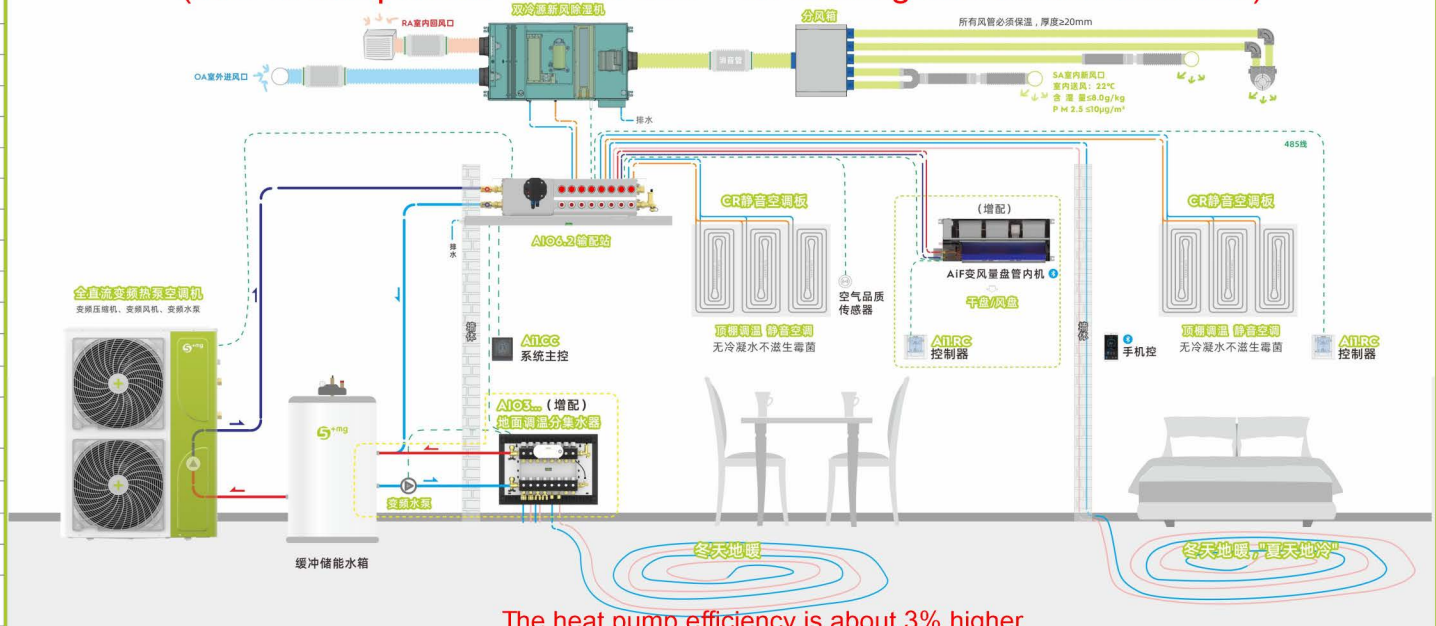
item information:

Owner's name:	contact way:	examine	
Green design:		proofread	
Power configuration:		affirm	

Merchant signature:

	Water distribution	AIO 6(AIO3)
	Smart Internet of things	APP/ cellphone
	Digital HVAC	Cloud operation and maintenance
Open the window to prevent knot dew		not applicable
	FCU	Medium-temperature dry coil or wind ciol
	Radiant panel	Bedroom air conditioning panel
	The ground temperature	Warm feet in winter
	Ventilation selection	Double cold source dehumidification new fan
	rate of ventilation	Bedroom is 1.2 times / hour
	technical strategy	Four seasons dehumidification fresh air
	constant temperature	20-26 ± 1.0℃, with a vertical temperature difference of 2.0℃
	constant humidity	40-60% or 11g / kg
	Constant oxygen	CO 2:700ppm, formaldehyde: 0.07mg / m³
	Constant pure	Bedroom micro-positive pressure of 5Pa, PM2.510 ug / m³ No condensation water, no mold growth
	Constant quiet	Bedroom silent, no access, no maintenance / respect privacy
	predict PPD	≤10%
Unit price according to the floor area		RMB 1350 / ㎡
Applicable area advice		125㎡
Suggestions for internal thermal insulation renovation		50mm polyurethane foam or EPS / EPP molded board for thermal insulation
Living hot water		Gas hot water wall hanging furnace can be added (Full premixed level 1 energy saving)
Water purification three-piece set proposal		Front filter (after the water meter) + ultrafiltration water purifier (Kitchen) + RO pure water machine (direct drinking)
toilet Electric floor heating with		RMB 3500 / unit below 10 square meters, Each additional 1 square meter is charged by 300 yuan
Negative pressure exhaust air increase		Toilet or chess room multi-point micro negative pressure exhaust (RMB 2,999 / set)
Local space addition		Bedroom positive pressure purification new fan / kitchen positive pressure Air repair / underground space dehumidifier fresh air air conditioning

Double cooling source dehumidification system
(built-in compressor + 6 row coil for cooling and dehumidification)



The heat pump efficiency is about 3% higher

when heating water temperature is 1 ℃ lower or the cooling water temperature is 1 ℃ higher .

High temperature cool water for cooling, low temperature hot water for heating.

Well3 Five-constant system air conditioning	Owner's name:	contact way:	examine	Merchant signature:
	Green design:		proofread	
item information:	Power configuration:		affirm	

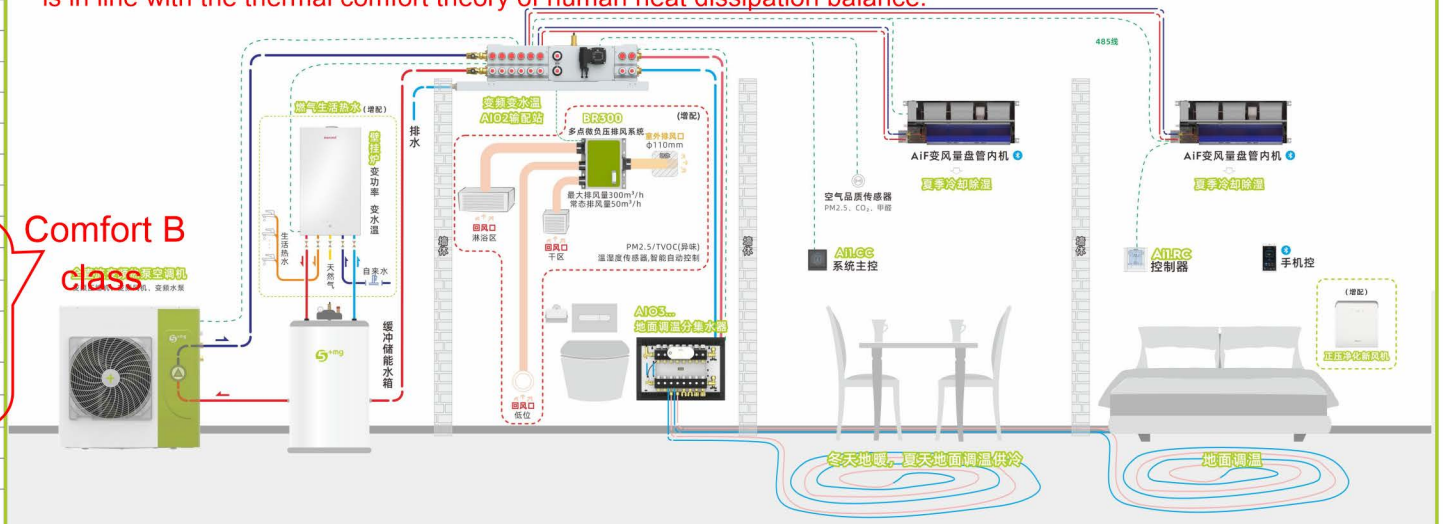
Water distribution	AIO 2(+AIO3)
Secondary change water temperature	Secondary change water temperature
Smart Internet of things	APP/ cellphone
Digital HVAC	Cloud operation and maintenance
Open the window to prevent knot dew	not applicable
FCU	To spread heat or dehumidification
Radiant panel	not applicable
The ground temperature	19~29℃
Ventilation selection	Can add the negative pressure exhaust air
rate of ventilation	not applicable
technical strategy	Summer FCUdehumidification
constant temperature	20-26 ± 1.5℃, with a vertical temperature difference of 4.0℃
constant humidity	35-65% or 12g / kg
Constant oxygen	Can add the bedroom positive pressure purification new fan
Constant pure	Can add negative pressure exhaust or waste fresh air system
Constant quiet	Low silent fan 35dB (A)
predict PPD	≤20%
Unit price according to the floor area	RMB 950 / ㎡
Applicable area advice	125㎡
Suggestions for internal thermal insulation renovation	50mm polyurethane foam or EPS / EPP molded board for thermal insulation
Living hot water	Gas hot water wall hanging furnace can be added (Full premixed level 1 energy saving)
Water purification three-piece set proposal	Front filter (after the water meter) + ultrafiltration water purifier (Kitchen) + RO pure water machine (direct drinking)
toilet Electric floor heating with	RMB 3500/ unit below 10 square meters, Each additional 1 square meter is charged by 300 yuan
Negative pressure exhaust air increase	Toilet or chess room multi-point micro negative pressure exhaust (RMB 2,999 / set)
Local space addition	Bedroom positive pressure purification new fan / kitchen positive pressure Air repair / underground space dehumidifier fresh air air conditioning

Comfort B class

Floor temperature adjustment : low temperature hot water in winter (~28℃) foot feeling warm, high temperature cold water for floor cooling in summer (~28W / m ²);

Convection heat transfer : the coil ventilation frequency is 1~3 times variable air volume (15~45W / m ²), No sensation of air blowing , super silent operation.

The adjustable ratio of radiation heat transfer (visible) and convection heat transfer (latent) is ~50% *, which is in line with the thermal comfort theory of human heat dissipation balance.

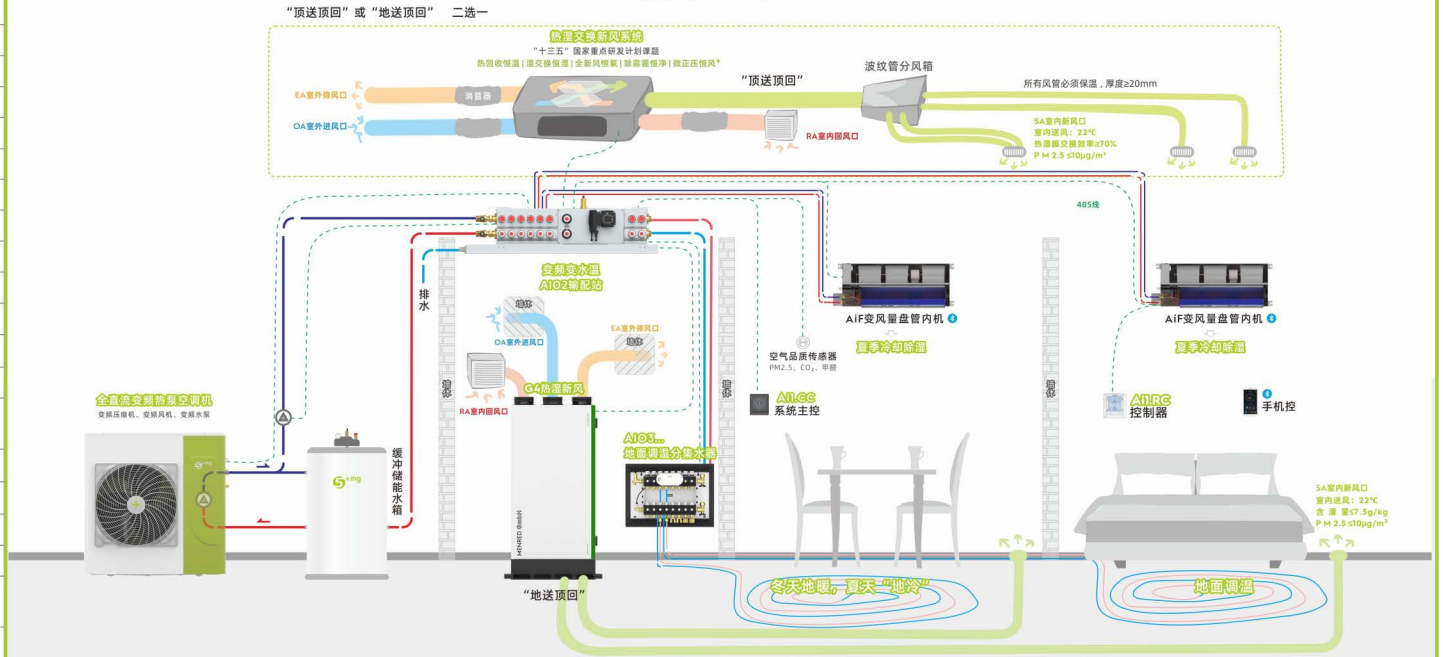


Note: "adjustable ratio ~50%" refers to the designed adjustable range of radiation and convection heat transfer, with the maximum convection of 45W / ㎡ and the maximum floor cooling of 42W / ㎡, with an adjustable ratio of about 50%. The purpose of convection is to reduce the moisture content of indoor air (constant humidity 40~60%), and radiation is for constant temperature (20~26 ± 1.5℃ arbitrarily adjustable).

Plus1 Five-constant system air conditioning	Owner's name:	contact way:	examine	Merchant signature:
	Green design:		proofread	
item information:	Power configuration:		affirm	

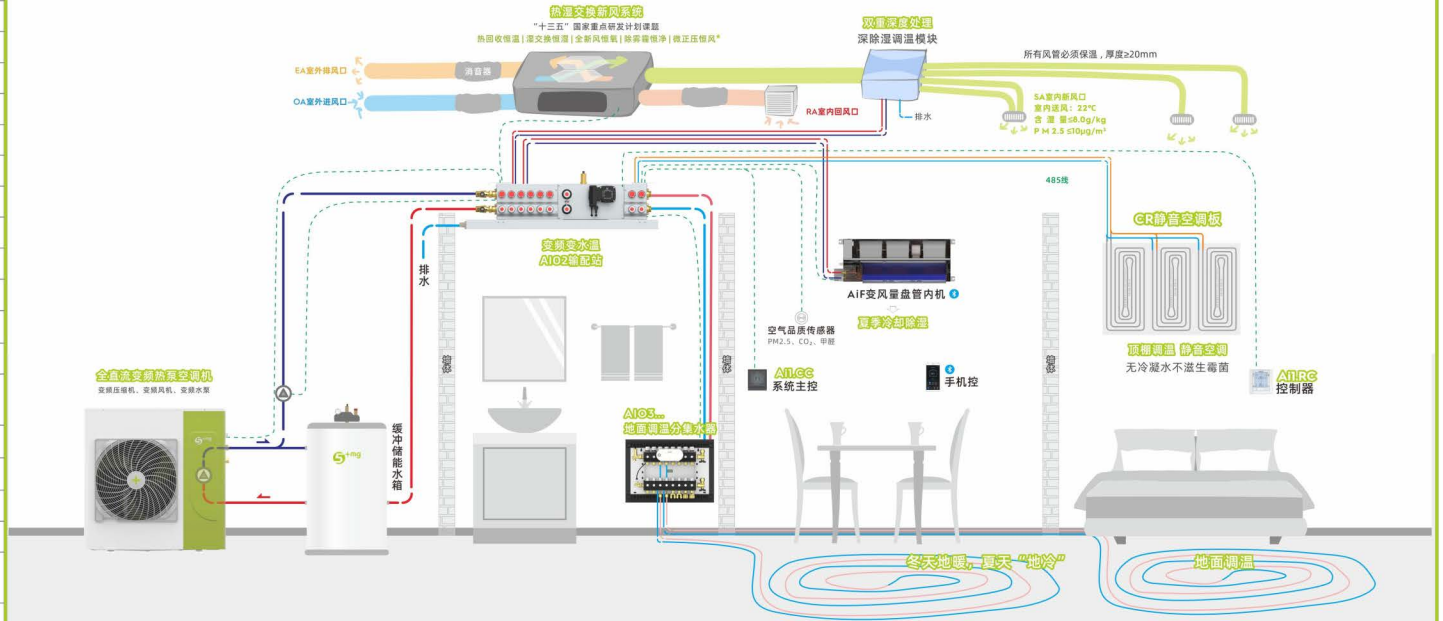
Water distribution	AIO 2+AIO3
Secondary change water temperature	Secondary change water temperature
Smart Internet of things	APP/ cellphone
Digital HVAC	Cloud operation and maintenance
Open the window to prevent knot dew	not applicable
FCU	To spread heat or dehumidification
Radiant panel	not applicable
The ground temperature	19~29℃
Ventilation selection	G4 hot and wet ventilator
rate of ventilation	Bedroom is 1.2 times / hour
technical strategy	Summer FCUdehumidification | wet exchange balance
constant temperature	20-26 ±1.5℃, with a vertical temperature difference of 3.0℃
constant humidity	35-65% or 12g / kg
Constant oxygen	CO 2:700ppm, formaldehyde: 0.05mg / m³
Constant pure	Bedroom micro-positive pressure of 5Pa, PM2.510 ug / m³
Constant quiet	Low silent fan 35dB (A)
predict PPD	≤15%
Unit price according to the floor area	RMB 1150/ ㎡
Applicable area advice	175㎡
Suggestions for internal thermal insulation renovation	50mm polyurethane foam or EPS / EPP molded board for thermal insulation
Living hot water	Gas hot water wall hanging furnace can be added (Full premixed level 1 energy saving)
Water purification three-piece set proposal	Front filter (after the water meter) + ultrafiltration water purifier (Kitchen) + RO pure water machine (direct drinking)
toilet Electric floor heating with	RMB 3500 / unit below 10 square meters, Each additional 1 square meter is charged by 300 yuan
Negative pressure exhaust air increase	Toilet or chess room multi-point micro negative pressure exhaust (RMB 2,999 / set)
Local space addition	Bedroom positive pressure purification new fan / kitchen positive pressure Air repair / underground space dehumidifier fresh air air conditioning

“ floor air supply, top return air” or
“ top air supply, top return air



Plus2 Five-constant system air conditioning	Owner's name:	contact way:	examine	Merchant signature:
	Green design:		proofread	
item information:	Power configuration:		affirm	

6 row coil dehumidification module (cooling dehumidification)
Advantages: wet balance / disadvantages: summer only



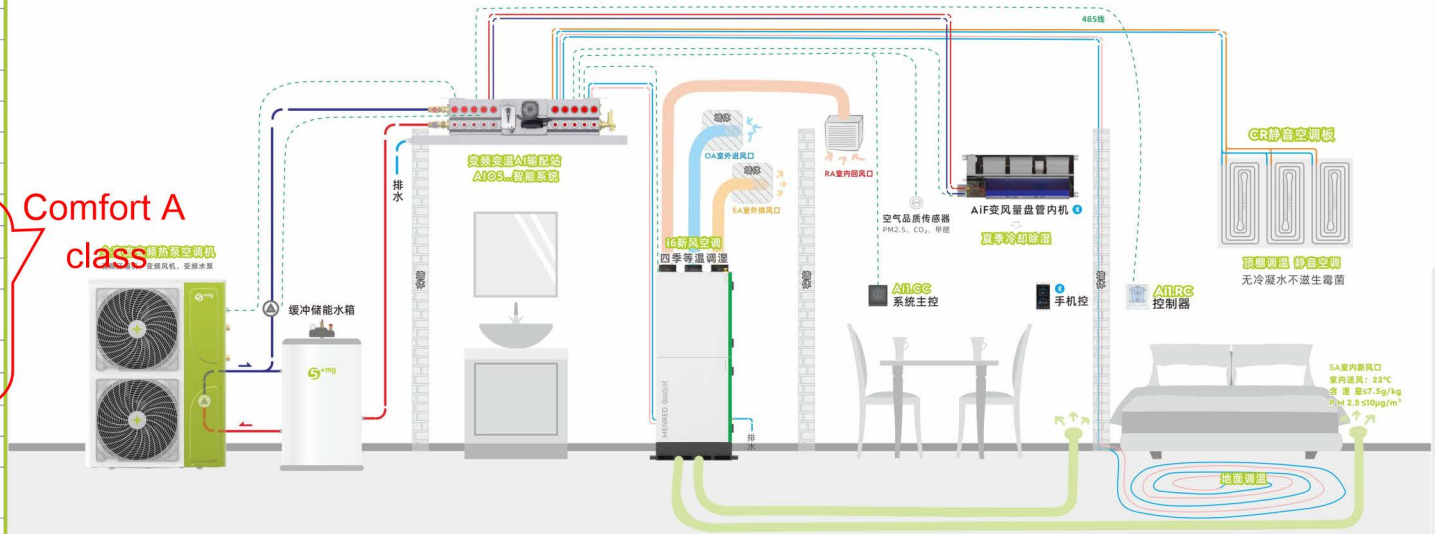
Water distribution		AIO 2+AIO3
Secondary change water temperature		Secondary change water temperature
Smart Internet of things		APP/ cellphone
Digital HVAC		Cloud operation and maintenance
Open the window to prevent knot dew		Open the window without dew
	FCU	To spread heat or dehumidification
	Radiant panel	Bedroom air conditioning board
	The ground temperature	19~29℃
	Ventilation selection	IEC5 hot and wet new fan
	rate of ventilation	Bedroom is 1.2 times / hour
technical strategy		Summer water coil dehumidification | wet exchange balance
	constant temperature	20-26 ± 1.0℃, with a vertical temperature difference of 2.0℃
	constant humidity	40-60% or 11g / kg
	Constant oxygen	CO 2:700ppm, formaldehyde: 0.05mg / m³
	Constant pure	Bedroom micro-positive pressure of 5Pa, PM2.510 ug / m³
	Constant quiet	Bedroom silent, no access, no maintenance / respect privacy
	predict PPD	≤10%
Unit price according to the floor area		RMB 1550/ ㎡
Applicable area advice		150㎡
Suggestions for internal thermal insulation renovation		50mm polyurethane foam or EPS / EPP molded board for thermal insulation
Living hot water		Gas hot water wall hanging furnace can be added (Full premixed level 1 energy saving)
Water purification three-piece set proposal		Front filter (after the water meter) + ultrafiltration water purifier (Kitchen) + RO pure water machine (direct drinking)
toilet Electric floor heating with		3,500 yuan / unit below 10 square meters, Each additional 1 square meter is charged by 300 yuan
Negative pressure exhaust air increase		Toilet or chess room multi-point micro negative pressure exhaust (RMB 2,999 / set)
Local space addition		Bedroom positive pressure purification new fan / kitchen positive pressure Air repair / underground space dehumidifier fresh air air conditioning

Plus3 Five-constant system air conditioning	Owner's name:	contact way:	examine	Merchant signature:
	Green design:		proofread	
item information:	Power configuration:		affirm	

Water distribution	AIO 5(+AIO3)
Secondary change water temperature	Secondary change water temperature
Smart Internet of things	APP/ cellphone
Digital HVAC	Cloud operation and maintenance
Open the window to prevent knot dew	Open the window without dew
FCU	Medium-temperature dry coil or wind coil
Radiant panel	Bedroom air conditioning board
The ground temperature	19~29℃
Ventialtion selection	The i6 fresh air conditioning
rate of ventilation	Bedroom is 1.2 times / hour
technical strategy	Four seasons dehumidification fresh air air conditioning | wet exchange balance
constant temperature	20-26 ±1.0℃, with a vertical temperature difference of 2.0℃
constant humidity	40-60% or 11g / kg
Constant oxygen	CO 2:700ppm, formaldehyde: 0.05mg / m³
Constant pure	Bedroom micro-positive pressure of 5Pa, PM2.510 ug / m³ No condensation water, no mold growth
Constant quiet	Bedroom silent, no access, no maintenance / respect privacy
predict PPD	≤15%
Unit price according to the floor area	RMB 1880/ ㎡
Applicable area advice	175㎡
Suggestions for internal thermal insulation renovation	50mm polyurethane foam or EPS / EPP molded board for thermal insulation
Living hot water	Gas hot water wall hanging furnace can be added (Full premixed level 1 energy saving)
Water purification three-piece set proposal	Front filter (after the water meter) + ultrafiltration water purifier (Kitchen) + RO pure water machine (direct drinking)
toilet Electric floor heating with	3,500 yuan / unit below 10 square meters, Each additional 1 square meter is charged by 300 yuan
Negative pressure exhaust air increase	Toilet or chess room multi-point micro negative pressure exhaust (RMB 2,999 / set)
Local space addition	Bedroom positive pressure purification new fan / kitchen positive pressure Air repair / underground space dehumidifier fresh air air conditioning

Comfort A class

Temperature and humidity independent control equipment (i6 built-in compressor, four seasons dehumidification)
Advantages: high temperature cold water for cooling, high heat pump efficiency.

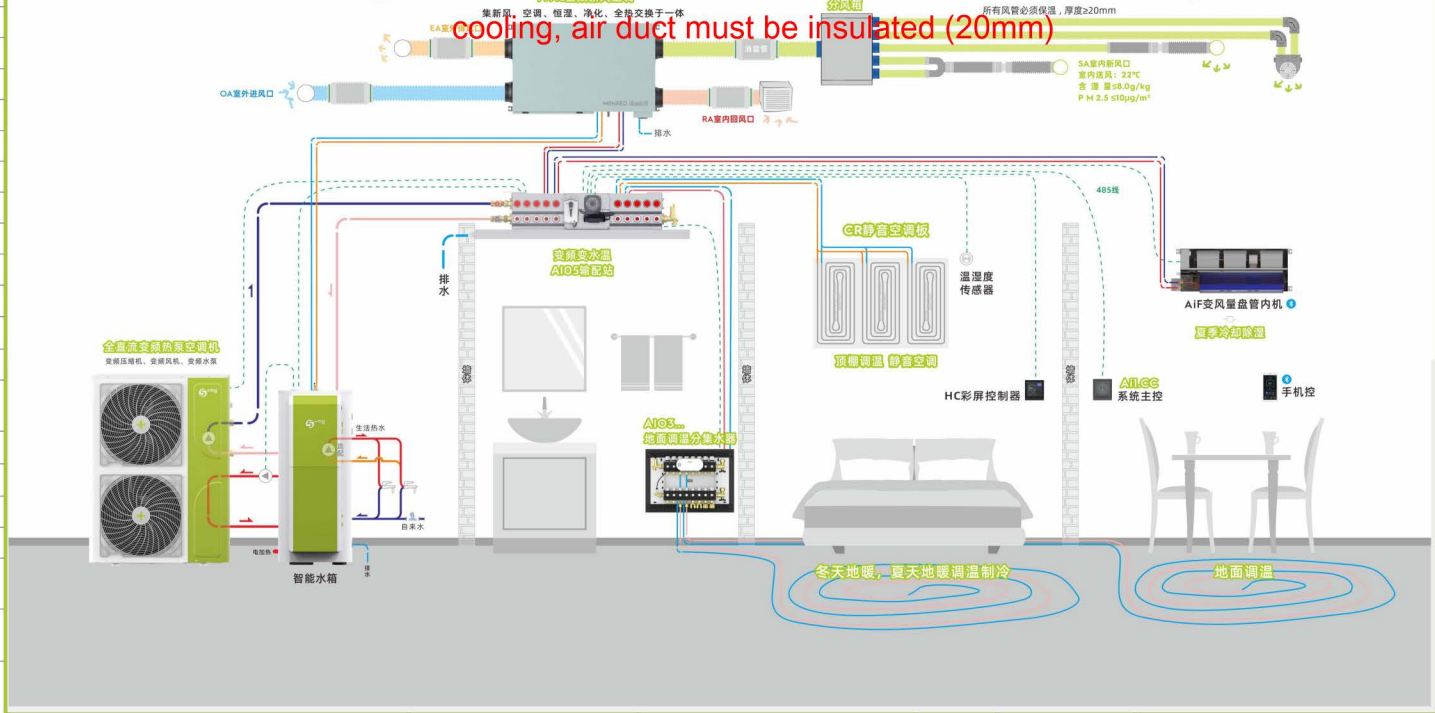


FCS 1Five-constant system air conditioning	Owner's name:	contact way:	examine	Merchant signature:
	Green design:		proofread	
item information:	Power configuration:		affirm	

Full function ventilation air conditioning of various models:

500~2500 air volume per hour

Warning: Cold source fresh air dehumidification or supplementary cooling, air duct must be insulated (20mm)



	Water distribution	AIO 5(+AIO3)
	Secondary change water temperature	Secondary change water temperature
	Smart Internet of things	APP/ cellphone
	Digital HVAC	Cloud operation and maintenance
	Open the window to prevent knot dew	Open the window without dew
	FCU	Medium-temperature dry plate or wind plate
	Radiant panel	Bedroom air conditioning board
	The ground temperature	19~29℃
	Ventilation selection	Fo 500 full-effect fresh air air conditioning
	rate of ventilation	Bedroom is 1.8 times / hour
	technical strategy	Full effect fresh air air conditioning dehumidification | wet exchange balance
	constant temperature	20-26 ± 1.0℃, with a vertical temperature difference of 2.0℃
	constant humidity	40-60% or 11g / kg
	Constant oxygen	CO 2:700ppm, formaldehyde: 0.05mg / m³
	Constant pure	Bedroom micro-positive pressure of 5Pa, PM2.510 ug / m³ No condensation water, no mold growth
	Constant queit	Bedroom silent, no access, no maintenance / respect privacy
	predict PPD	≤10%
Unit price according to the floor area		RMB 2280 / ㎡
	Applicable area advice	200㎡
	Suggestions for internal thermal insulation renovation	50mm polyurethane foam or EPS / EPP molded board for thermal insulation
	Living hot water	Gas hot water wall hanging furnace can be added (Full premixed level 1 energy saving)
	Water purification three-piece set proposal	Front filter (after the water meter) + ultrafiltration water purifier (Kitchen) + RO pure water machine (direct drinking)
	toilet Electric floor heating with	3,500 yuan / unit below 10 square meters, Each additional 1 square meter will charge 300 yuan
	Negative pressure exhaust air increase	Toilet or chess room multi-point micro negative pressure exhaust air (RMB 2,999 / set)
	Local space addition	Bedroom positive pressure purification new fan / kitchen positive pressure Air repair / underground space dehumidifier fresh air air conditioning

FCS2Five-constant system air conditioning

item information:

Owner's name:	contact way:	examine	
Green design:		proofread	
Power configuration:		affirm	

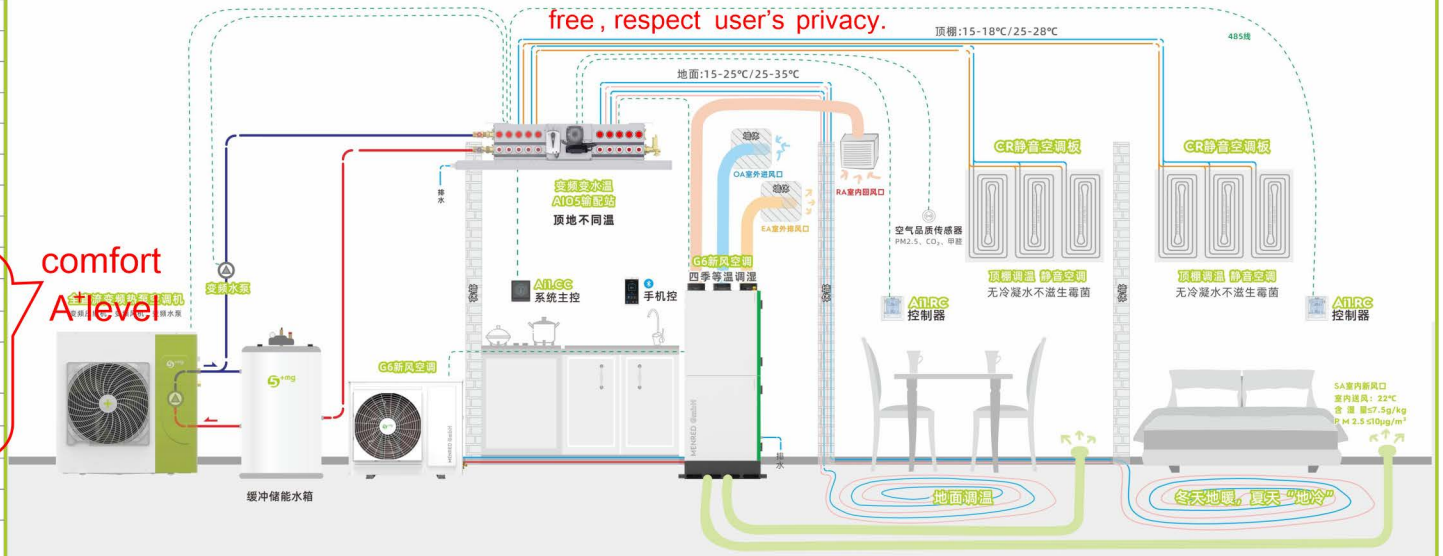
Merchant signature:

Water distribution	AIO 5
Secondary change water temperature	The top ground is different temperature
Smart Internet of things	APP/ cellphone
Digital HVAC	Cloud operation and maintenance
Open the window to prevent knot dew	Open the window without dew
FCU	No internal machine
Radiant panel	Full house air conditioning board
The ground temperature	19~29℃
Ventilation selection	G6 fresh air conditioning
rate of ventilation	Bedroom is 1.2 times / hour
technical strategy	Four seasons dehumidification fresh air conditioning | wet exchange balance
constant temperature	20-26 ±0.5℃, with a vertical temperature difference of 2.0℃
constant humidity	40-60% or 10g / kg
Constant oxygen	CO 2:700ppm, formaldehyde: 0.05mg / m³
Constant pure	Bedroom micro-positive pressure of 5Pa, PM2.510 ug / m³ No condensation water, no mold growth
Constant quiet	Bedroom silent, no access, no maintenance / respect privacy
predict PPD	≤5%
Unit price according to the floor area	RMB 2680/㎡
Applicable area advice	150㎡
Suggestions for internal thermal insulation renovation	50mm polyurethane foam or EPS / EPP molded board for thermal insulation
Living hot water	Gas hot water wall hanging furnace can be added (Full premixed level 1 energy saving)
Water purification three-piece set proposal	Front filter (after the water meter) + ultrafiltration water purifier (Kitchen) + RO pure water machine (direct drinking)
toilet Electric floor heating with	3,500 yuan / unit below 10 square meters, Each additional 1 square meter will charge 300 yuan
Negative pressure exhaust air increase	Toilet or chess room multi-point micro negative pressure exhaust air (RMB 2,999 / set)
Local space addition	Bedroom positive pressure purification new fan / kitchen positive pressure Air repair / underground space dehumidifier fresh air air conditioning

G6 fresh air conditioning independent dehumidification, the whole house with radiation heat transfer panel , different water temperature between roof and floor .

Bedroom: no mechanical and electrical equipment, silent, no wind blowing , no access port , maintenance free , respect user's privacy.

comfort A level



FCS 3Five-constant system air conditioning	Owner's name:	contact way:	examine	Merchant signature:
	Green design:		proofread	
item information:	Power configuration:		affirm	

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Ten points of summary of the design scheme:

1 Green advice:

Renovation of building envelope structure: $N_{50} \leq 1.0$ times / h, comprehensive average heat transfer coefficient (K value) $\leq 1.0 W / m^2 \cdot ℃$;

When the heat load is 50W / m^2, the power consumption of 100 square meters is less than 900 kwh / month (no more than RMB 500).

2. Power configuration:

Power selection of heat pump = (total building area * heat load), such as the heat load is 100W / m^2 * 150 m^2 =15KW;

Power selection of FCU = heat load * area * 1.5 (enhancement coefficient), enhancement coefficient should appropriately increase with large French glass window or direct sunlight from west.

3. Device selection:

It is recommended to use "dynamic and static partition" design principle, FCU for dynamic area, radiant panel for static area. "static zone" refers to static changes of hot and wet load Such as bedroom, study, etc.); "dynamic area" refers to dynamic changes of hot and wet load, such as living room, dining room, gym, etc.

4. Water pump type selection:

According to the equipment (or built-in pump), device and pipe resistance, water piping method and other factors, choose the pump head and flow correctly.

Flow (l / minute) = transmission power (KW) ÷ Δ T (water supply and return temperature difference) ÷ 0.07; the pump must be correctly selected.

5 Convection heat transfer :

The FCU is selected according to the medium air gear or 60% air volume, and designed air circulation is about 5 times / h;

The cubic air volume of heat transfer or cold source fresh air is calculated as 5W, and the insulation thickness of cold source or dehumidification fresh air pipe is at least 20mm.

Ten points of summary of the design scheme:

6. Radiation heat transfer:

The paving rate of radiant panel is ≥ 60%. Underfloor coil is not necessary for wood floor area, but insulation board needed ; the design scheme shall prevail.

Design limit: roof air conditioning, ceiling cooling≤ 99W / ㎡, floor cooling ≤ 42W / ㎡.

7. Comfort evaluation:

The design index is based on the premise of hardware configuration and system adjustment, evaluating in indoor heating 20℃ or cooling 26℃ environment;

The constant temperature fluctuation value and the vertical temperature difference value (the temperature difference between 0.1 and 1.1 m above ground).

8 Area unit price:

Calculated according to the building area, the price includ es design, installation, adjustment and warranty, excluding additional part; special house type needs different configuration .

The total contract price is subject to the design scheme, and 10% service fee will be charged in first-tier cities and suburbs over 100 kilometers.

9 ten-day project :

According to the planned 10-day construction period for a 100㎡ house , 5 days of equipment installation in the early stage, 3 days of product debugging in the middle stage, system adjustment and delivery in the la st 2 days;

5 + 3 + 2 days interspersed during the decoration, site decoration personnel needs to leave the field during installation .

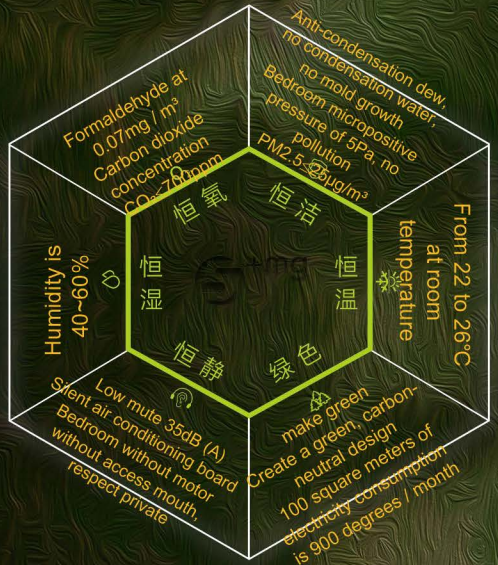
10 ten-year warranty:

Additional Tripartite Agreement shall be signed, strictly following the classic scheme design or reviewed by SDC center , And complete the “ Service LJJ” mini program extended warranty registration.

Five-constant standard definition

Five constant design ind ex

"Five constant and one green" value proposition



Comfort grade evaluation

Overall thermal sensation dissatisfaction rate PPD:

Grade A + ≤10%; Grade A ≤15%; Grade B ≤20%

Room temperature fluctuation limit:

Grade A + ≤1.0°C; Grade A ≤1.5°C; Grade B ≤2.0°C

Vertical temperature difference limits:

Grade A + ≤2°C; Grade A ≤3°C; Grade B ≤4°C

Building Surface Limit value:

Ground temperature regulation 19~29°C; roof surface ≥17°C

Note: For different design grades, the scheme configuration shall prevail.

Menred Group official announcement

Technical Standard for Near-Zero Energy Consumption Buildings / Technical Standard for Zero Carbon Buildings / Energy Saving Design Standard for Public Buildings / Heat Recovery and Fresh Air Unit Fan Coel Unit / Household Fresh Air Dehumidifier, Heat Pump Fresh Air Environment Control Machine / Technical Specification for Radiation Heating and Cooling

And other 27 national standard drafting units

National high-tech enterprise / specialization, special and new · little giant / green factory / beautiful factory

Partner of State Key Laboratory of Future Construction / undertake sub-project of national 13th Five-Year Key Research and Development Plan

五恒系统空调

make green 创造绿色

Innovation for building carbon neutrality!

On System air Conditioning, human thermal comfort

Summary 1:

Human thermal comfort theory

Thermal balance is a necessary condition, and the heat dissipation ratio is a sufficient condition.

Human is always a heat sink, an appropriate heat dissipation ratio can maintain a relatively constant body temperature

Five-constant standard definition

According to the overall dissatisfaction PPD and local dissatisfaction PD and temperature limits,

be divided into A $^{+}$, A, B, three thermal comfort levels

"Five-constant design with indicators; comfort evaluation with grade"

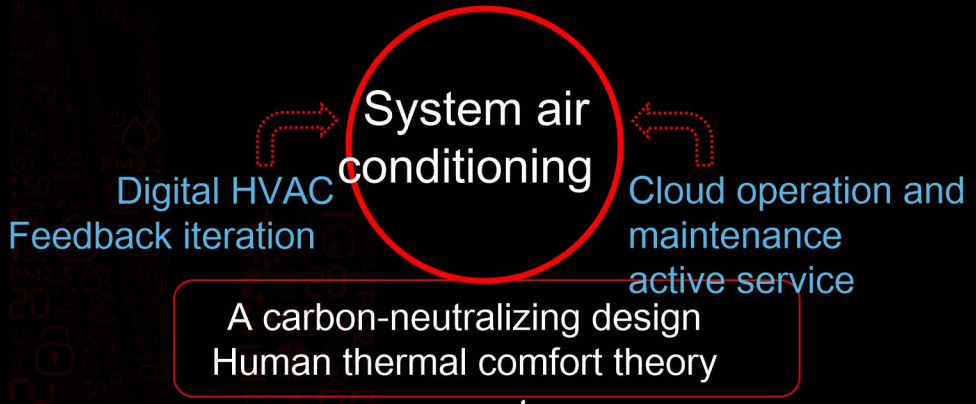
(Joint Initiative / Owner Certification / Annual Awards)

menred

曼瑞德@舒适家

Summary 2:

Capacity / boundaries / values / ideas



core competence :

Full-category manufacturing, standardized customization (area unit price with coresponding scheme)

Cognitive boundaries :

Ten times good products, ten times good growth rate (sole agency for one city signed; floor heating + ventilation 50 billion, air conditioning 500 billion +)

Perceived value :

Tripartite agreement, 10-year warranty; 100 square meters of power consumption 500 yuan / month (make green)

Ontology concept :

Aesthetic and comfortable home, Innovation for building carbon neutrality !(Innovative ideas / innovative design / innovative entrepreneurship)

五恒城市会客厅:东莞　　成都　　上海　　苏州　　沈阳...

Thanks

五恒标准定义者

全国招商/ 一城独签

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