Foreword

According to the requirements of *Notice on Printing the Development and Revision Plan of National Engineering Construction Standards and Codes in 2016* (JIANBIAO HAN [2015] No. 274) issued by the Ministry of Housing and Urban-Rural Development, this standard was produced by the drafting group on the basis of extensive research and investigation, experience gathered from practices, referencing relevant international standards and advanced foreign standards, and solicited opinions of various backgrounds.

The main technical content of this standard includes: 1. General provisions; 2. Terms; 3. Basic requirements; 4. Indoor environment parameters; 5. Energy efficiency criteria; 6. Technical parameters; 7. Technical measures; 8. Evaluation.

The Ministry of Housing and Urban-Rural Development oversees the administration of this standard. China Academy of Building Research is responsible for the explanation of specific technical contents. During the process of implementation, any relevant opinions and advice shall notify China Academy of Building Research (Address: No. 30, North 3rd Ring East Road, Beijing, Postal code 100013, China).

Chief Development Organizations:

China Academy of Building Research
Hebei Construction Science Academy

Participating Development Organizations:

Ronghua Construction General Company
Beijing Institute of Architectural Design
Tsinghua University
Harbin Institute of Technology
Xi'an University of Architecture and Technology
South China University of Technology
China Construction Science & Technology Group Co., Ltd.
China Southwest Architectural Design and Research Institute Corp. Ltd.
Beijing Institute of Residential Building Design & Research Co., Ltd.
Xinjiang Architectural Design Institute Co., Ltd.
Werkhart International Design and Engineering Consultancy Co. Ltd. Beijing
Tianjin Architecture Design Institute
Shanghai Research Institute of Building Sciences (Group) Co. Ltd.
East China Architectural Design and Research Institute Co., Ltd.
Shandong Institute of Building Science
Henan Fivewin Architectural design Co., Ltd.
Shenzhen Institute of Building Research Co., Ltd.
Dalian University of Technology
University of Science and Technology Beijing

Sino-German Ecopark Passive House Building Technology Co. ,Ltd.
Qinhuangdao Wuxing Real Estate Co. ,Ltd.
Jiangsu Nantong Sanjian Construction Group Co. , Ltd.
China Gezhouba Group Real Estate Corporation
Hebei Orient Sundar Window Industry Co. , Ltd.
TANGENT Software
MENRED Group
Siemens Ltd. China
Qingdao Kerui New Environmental Materials Group Co. , Ltd.
Beijing Dongbang Green Building Technology Co. , Ltd.
Beijing COLE Building Energy Conservation Technology Co. ,Ltd.
3M China Limited
WAREMA Sunshading Systems (Shanghai) Co. ,Ltd.
GREE Electric Appliances,Inc. of Zhuhai Co. ,Ltd.
Midea Heating & Ventilating Equipmen tCo. ,Ltd.
Daikin (China) Investment Co. , Ltd.
Carrier Air Conditioning Sales & Service (Shanghai) Co. , Ltd.
Zehnder(China)Indoor Climate Co. , Ltd.
Anhui Anze Electric Co. , Ltd.
Jiangsu Fengshen Air Conditioning Group Co. , Ltd.
Nather Ventilation System Co. , Ltd.
Hundred Wissenschafts-Technikges. mbH.
Technovator International Limited
Eneco Environment & Energy Co. , Ltd.
Jiangsu Sunrain Solar Energy Co. ,Ltd.
Guoanrui (Beijing) Technology Co. , Ltd.

Chief Drafting Staff:

Xu Wei, Zou Yu, Yu Zhen, Sun Deyu, Qiang Wanming, Zhang Xingliang, Xu Hongqing, Zhang Shicong, Wu Jianlin, Hao Cuicai, Song Yehao, Fang Xiumu, Chen Xi, Sun Zhifeng, Liu Yanfeng, Zhao Lihua, Li Congxiao, Yang Yuzhong, Wan Chenglong, Feng Ya, Hu Yiheng, Liu Ming, Lu Qiu, Wu Xiaoting, Yang Jianrong, Yu Zhengjie, Shao Kangwen, Xia Lin, Wang Zhao, Cui Guoyou, Hao Bin, DuanMu lin, Qu Shilin, Wang Zhen, Zhou Binggao, Jiao Jiahai, Wei Hedong, Dou Chunlun, Chen Linan, Li Zhuangxian, Huo Yujia, Wu Yazhou, Wang Xin, Jin Guoxiang, Hu Yusheng, Huang Guoqiang, Zhong Ming, Yang Liming, Guo Zhangeng, Zhang Junye, Lu Hui, Jin Chunlin, Cong Xuri, Zheng Wei, Zhao Xiaoyu, Li Guangyu, Jiao Qingtai, Song Bo, Yang Xinyan

Chief Examiners:

Liu Jiaping, Wang Chongjie, Zhong Jishou, Li Deying, Feng Guohui, Shen Jinghua, Peng Mengyue, Xue Feng, Chen Qi, Luan Jingyang, Zhao Shihuai

Contents

1 General Provisions

1.0.1 This standard is developed to implement relevant national laws，regulations，guidelines and policies，improve the quality of indoor environment and building quality，reduce energy demand，enhance energy efficiency，and promote the application of renewable energy in buildings，leading building constructions to gradual transition to nearly zero energy.

1.0.2 This standard is applicable to the design，construction，operation and evaluation of nearly zero energy building.

1.0.3 The design，construction，operation and evaluation of buildings shall comply with those specified in both this standard and the current relevant national standards.

2 Terms

2.0.1 nearly zero energy building

Building which 1) can adapt to climate characteristics and site conditions, 2) reduces the heating, air conditioning and lighting requirements of its operation to the maximum extent through passive architectural design, 3) improves the efficiency of energy equipment and systems to the maximum extent through active technical measures, and 4) provides comfortable indoor environment with the least energy consumption by making full use of renewable energy. Moreover, building whose indoor environment parameters and energy efficiency indicator comply with the requirements of this standard, shall have an energy consumption level that is at least 60%～75% lower than the national standard of GB 50189－2015 *Design standard for energy efficiency of public buildings*, the professional standards JGJ 26－2010 *Design standard for energy efficiency of residential buildings in severe cold and cold zones*, JGJ 134－2016 *Design standard for energy efficiency of residential buildings in hot summer and cold winter zones*, and JGJ 75－2012 *Design standard for energy efficiency of residential buildings in hot summer and warm winter zone*.

2.0.2 ultra low energy building

Nearly zero energy building in its earlier stage, whose indoor environmental parameters are the same as those of nearly zero energy building, while its energy efficiency indicator is of slightly lower than that of nearly zero energy building. Its building energy consumption level that is at least 50% lower than the national standard GB 50189－2015 *Design standard for energy efficiency of public buildings*, the professional standards JGJ 26－2010 *Design standard for energy efficiency of residential buildings in severe cold and cold zones*, JGJ 134－2016 *Design standard for energy efficiency of residential buildings in hot summer and cold winter zones*, and JGJ 75－2012 *Design standard for energy efficiency of residential buildings in hot summer and warm winter zone*.

2.0.3 zero energy building

An advanced form of nearly zero energy building whose indoor environmental parameters are the same as those of nearly zero energy building, and the renewable energy resources in both the building and its surroundings are fully utilized, so that the annual renewable energy output is greater than or equal to the total energy consumption of the building throughout the year.

2.0.4 performance oriented design

Design process during which the design scheme is gradually optimized based on the results of simulations performed under certain targets of indoor environmental parameters and energy efficiency indicator of buildings using building simulation tools, eventually achieving the predetermined performance targets.

2.0.5 air tightness layer

A continuous structural layer formed by air-tight materials and parts, plastering layers, etc. that preventsair infiltration.

2.0.6 building energy consumption

Under set calculation conditions, the difference between the annual end-use energy of heating, ventilation, air conditioning, lighting, domestic hot water, elevators, and the amount of electrical energy produced by renewable energy system per unit area to the standard coal using the energy conversion coefficient.

2.0.7 annual heating demand

annual cumulative heating consumption per unit area supplied by indoor heating equipment in order to meet the requirements of indoor environmental parameters under set calculation conditions.

2.0.8 annual cooling demand

Annual cumulative cooling consumption per unit area supplied by indoor cooling equipment, in order to meet the requirements of indoor environmental parameters, under set calculation conditions.

2.0.9 air tightness of building envelope

The ability of a building to prevent air infiltration in a closed state. This ability of the building is used to characterize the amount of unorganized air permeation of a building or room under normal sealing conditions. Generally, the air tightness of buildings is tested by differential pressure experiment and characterized by the air exchange rate N_{50}, i. e., the air exchange rate under the indoor and outdoor pressure difference of 50Pa.

2.0.10 utilization ratio of renewable energy

The ratio of renewable energy utilization in heating, ventilation, air conditioning, lighting, domestic hot water, and elevator system to its energy demand.

2.0.11 building energy saving rate

The ratio of the difference between the energy consumption of the design building and that of the reference building to the energy consumption of the reference building.

2.0.12 building energy efficiency improvement rate

Under set calculation conditions, the ratio of the difference between the building energy consumption of the design building excluding electricity generated by renewable energy and the building energy consumption of the reference building to the building energy consumption of the reference building.

2.0.13 sensible heat exchange efficiency

The ratio of temperature difference between theoutdoor air inlet and supply air outlet of corresponding air volume to the temperature difference between outdoor air inlet and return air inlet.

2.0.14 total heat exchange efficiency

The ratio of enthalpy difference between the outdoor air inlet and supply air outlet of corresponding air volume to the enthalpy difference between the outdoor air inlet and return air inlet.

2.0.15 thermally broken fixer

Anchor that can effectively reduce or block the thermal bridge effect of anchor nail through special structural design.

2.0.16 waterproof and vapor-permeable material

Material that seals the gap on the outdoor side of the building envelope, is waterproof, and has water vapor permeable functions.

2.0.17 air tightness material

Material that seals the gap inside the building envelope and prevents air infiltration.

2.0.18 reference building

Building that is used to calculate the building energy consumption that meets relevant requirements given the national standard GB 50189－2015 *Design standard for energy efficiency of public buildings*, the professional standards JGJ 26－2010 *Design standard for energy efficiency of residential buildings in severe cold and cold zones*, JGJ 134－2016 *Design standard for energy efficiency of residential buildings in hot summer and cold winter zones*, and JGJ 75－2012 *Design standard for energy efficiency of residential buildings in hot summer and warm winter zone*, when calculating the building energy efficiency improvement rate and the building energy saving rate.

3 Basic Requirements

3.0.1 Based on climate characteristics and site conditions, the architectural design shall using passive design to decrease building's requirement of cooling and heating energy and increase the energy efficiency of the active energy system in order to achieve ultra-low energy building, on top of that using renewable energy to balance and substitute consumed energy to achieve nearly zero energy building, or zero energy building when conditions are met.

3.0.2 Indoor environmental parameters and energy efficiency indicator shall be regarded as binding indicators. Performance parameters such as building envelope, energy equipment and system shall be recommended indicators.

3.0.3 The calculation of energy efficiency indicator shall comply with the requirements in Appendix A.

3.0.4 Performance-based design, refined construction technology, quality control and intelligent operation mode shall be adopted.

3.0.5 Full decoration shall be carried out. Indoor decoration shall be simple, shall not damage the air tightness layer of Building envelope and affect air flow, and should adopt materials and parts that have obtained green building materials identification (or certification).

4 Indoor Environment Parameters

4.0.1 The indoor thermal and humid environment parameters of the main rooms in the building shall meet the requirements in Table 4.0.1.

Table 4.0.1 Indoor thermal and humid environment parameters of the main rooms in the building

Indoor thermal and humid environment parameter	Winter	Summer
Temperature (℃)	≥20	≤26
Relative humidity (%)	≥30	≤60

Notes: 1. The indoor relative humidity in winter is not included in the selection of equipment and calculation of energy efficiency indicator.

2. If air conditioning facilities are not set up in severe cold zone, indoor thermal and humid environment parameters in summer may not be included in the selection of equipment and calculation of energy efficiency indicator; if heating facilities are not set up in hot summer and warm winter zone and temperate zone, indoor thermal and humid environment parameters in winter may not be included in the selection of equipment and calculation of energy efficiency indicator.

4.0.2 The indoor fresh air volume in the main rooms of residential buildings shall not be less than 30m^3/(h · person). The fresh air volume in the public buildings shall comply with the requirements of the current national standard GB 50736 *Design code for heating ventilation and air conditioning of civil buildings*.

4.0.3 The indoor noise of residential buildings shall not be greater than 40dB(A) in the daytime and not be greater than 30 dB(A) at night. The indoor noise level of hotel buildings shall comply with the requirements of limits for noise levels class 1 of hotel buildings of the current national standard GB 50118 *Code for design of sound insulation of civil buildings*; limits for indoor noise levels of other building types shall comply with the highest requirements of the current national standard GB 50118 *Code for design of sound insulation of civil buildings*.

5 Energy Efficiency Criteria

5.0.1 The energy efficiency indicator of nearly zero energy residential buildings shall meet the requirements in Table 5.0.1.

Table 5.0.1 Energy efficiency indicator of nearly zero energy residential buildings

Building energy consumption		≤55(kWh/(m² · a)) or ≤6.8(kgce/(m² · a))				
Performance indicator of building body	Annual heating demand (kWh/(m² · a))	Severe cold zone	Cold zone	Hot summer and cold winter zone	Temperate zone	Hot summer and warm winter zone
		≤18	≤15	≤8		≤5
	Annual cooling demand (kWh/(m² · a))	$\leq 3+1.5\times WDH_{20}+2.0\times DDH_{28}$				
	Air tightness of building envelope (Air exchange rate N_{50})	≤0.6		≤1.0		
Utilization ratio of renewable energy		≥ 10%				

Notes: 1. The energy consumption of lighting, domestic hot water and elevator system in the performance indicator of building body are constrained by the building energy consumption. No specific limit is required for each of them.

2. This table is applicable to residential buildings in the category of residential buildings. The calculation baseline of area is the usable area in the dwelling unit.

3. WDH_{20} (Wet-bulb degree hours 20) is the hourly cumulative value of the difference between wet bulb temperature when the outdoor wet bulb temperature is higher than 20℃ in a year and the temperature of 20℃ (expressed in kKh).

4. DDH_{28} (Dry-bulb degree hours 28) is the hourly cumulative value of the differencebetween dry bulb temperature when the outdoor dry bulb temperature is higher than 28℃ in a year and the temperature of 28℃ (expressed in kKh).

5.0.2 The energy efficiency indicator of nearly zero energy public buildings shall meet the requirements in Table 5.0.2. Building energy of such buildings may be determined according to Appendix B of this standard.

Table 5.0.2 Energy efficiency indicator of nearly zero energy public buildings

Building energy saving rate		≥ 60%				
Performance indicator of the building body	Building energy efficiency improvement rate	Severe cold zone	Cold zone	Hot summer and cold winter zone	Hot summer and warm winter zone	Temperate zone
		≥ 30%		≥ 20%		
	Air tightness of building envelope (Air exchange rate N_{50})	≤1.0		—		
Utilization ratio of renewable energy		≥ 10%				

Note: This table is also applicable to non-dwelling residential buildings.

5.0.3 The energy efficiency indicator of ultra-low energy residential buildings shall meet the requirements in Table 5.0.3.

Table 5.0.3 Energy efficiency indicator of ultra-low energy residential buildings

Building energy consumption		≤65(kWh/(m²·a)) or ≤8.0(kgce/(m²·a))				
Performance indicator of building body	Annual heating demand (kWh/(m²·a))	Severe cold zone	Cold zone	Hot summer and cold winter zone	Temperate zone	Hot summer and warm winter zone
		≤30	≤20	≤10		≤5
	Annual cooling demand (kWh/(m²·a))	$\leqslant 3.5+2.0\times WDH_{20}+2.2\times DDH_{28}$				
	Air tightness of building envelope (Air exchange rate N_{50})	≤0.6		≤1.0		

Notes: 1. The energy consumption of lighting, domestic hot water and elevator system in the performance indicator of building body are constrained by the building energy consumption. No specific limit is required for each of them.

2. This table is applicable to dwelling buildings in residential buildings. The calculation baseline of area is the usable area in the dwelling unit.

3. WDH_{20} (Wet-bulb degree hours 20) is the hourly cumulative value of the difference between wet bulb temperature when the outdoor wet bulb temperature is higher than 20℃ in a year and the temperature of 20℃ (expressed in kKh).

4. DDH_{28} (Dry-bulb degree hours 28) is the hourly cumulative value of the difference betweendry bulb temperature when the outdoor dry bulb temperature is higher than 28℃ in a year and the temperature of 28℃ (expressed in kKh).

5.0.4 The energy efficiency indicator of ultra-low energy public buildings shall meet the requirements in Table 5.0.4.

Table 5.0.4 Energy efficiency indicator of ultra-low energy public buildings

Building energy saving rate		≥50%				
Performance indicator of building body	Building energy efficiency improvement rate	Severe cold zone	Cold zone	Hot summer and cold winter zone	Hot summer and warm winter zone	Temperate zone
		≥25%		≥20%		
	Air tightness of building envelope (Air exchange rate N_{50})	≤1.0		—		

Note: This table is also applicable to non-dwelling residential buildings.

5.0.5 The efficiency indicator of zero-energy residential buildings shall comply with the following requirements:

1 The performance indicator of building body shall comply with the requirements of Table 5.0.1 in this standard;

2 The renewable exported energy in the building body and its surroundings shall not be less than the annual end-use energy consumption of the building.

5.0.6 The efficiency indicator of zero-energy public buildings shall comply with the following requirements:

1 The performance indicator of building body shall comply with the requirements of Table 5.0.2 in this standard;

2 The renewable exported energy in the building body and its surroundings shall nob be less than the annual end-use energy consumption of the building.

6 Technical Parameters

6.1 Building Envelope

6.1.1 The average heat transfer coefficient of opaque building envelope of residential buildings may be selected according to data in Table 6.1.1.

Table 6.1.1 Average heat transfer coefficient of opaque building envelope of residential buildings

Building envelope position	Heat transfer coefficient K (W/(m^2·K))				
	Severe cold zone	Cold zone	Hot summer and cold winter zone	Hot summer and warm winter zone	Temperate zone
Roofing	0.10～0.15	0.10～0.20	0.15～0.35	0.25～0.40	0.20～0.40
Exterior wall	0.10～0.15	0.15～0.20	0.15～0.40	0.30～0.80	0.20～0.80
Ground and overhanging floor slab	0.15～0.30	0.20～0.40	—	—	—

6.1.2 The average heat transfer coefficient of opaque building envelope of public buildings may be selected according to data in Table 6.1.2.

Table 6.1.2 Average heat transfer coefficient of opaque building envelope of public buildings

Building envelope position	Heat transfer coefficient K (W/(m^2·K))				
	Severe cold zone	Cold zone	Hot summer and cold winter zone	Hot summer and warm winter zone	Temperate zone
Roofing	0.10～0.20	0.10～0.30	0.15～0.35	0.30～0.60	0.20～0.60
Exterior wall	0.10～0.25	0.10～0.30	0.15～0.40	0.30～0.80	0.20～0.80
Ground and overhanging floor slab	0.20～0.30	0.25～0.40	—	—	—

6.1.3 The average heat transfer coefficient of opaque building envelope for separating heating space and non-heating space may be selected according to data in Table 6.1.3.

Table 6.1.3 Average heat transfer coefficient of opaque building envelope for separating heating space and non-heating space

Building envelope position	Heat transfer coefficient K (W/(m^2·K))	
	Severe cold zone	Cold zone
Floor slab	0.20～0.30	0.30～0.50
Partition wall	1.00～1.20	1.20～1.50

6.1.4 The air-tightness performance of external doors and windows shall comply with the following requirements:

1 The air-tightness performance of external windows shall not be lower than level 8;

2 The air tightness performance of external doors and doors separating heating space from non-heating space shall not be lower than level 6.

6.1.5 Thermal performance parameters of external windows of residential buildings (including transparent curtain walls) may be selected according to data in Table 6. 1. 5-1. Thermal performance parameters of external windows (including transparent curtain walls) of public buildings may be selected according to data in Table 6. 1. 5-2.

Table 6. 1. 5-1 External windows of residential buildings (including transparent curtain walls) heat transfer coefficient (*K*) and solar heat gain coefficient (*SHGC*)

Performance parameter		Severe cold zone	Cold zone	Hot summer and cold winter zone	Hot summer and warm winter zone	Temperate zone
Heat transfer coefficient K(W/(m^2 · K))		≤1. 0	≤1. 2	≤2. 0	≤2. 5	≤2. 0
Solar heat gain coefficient *SHGC*	Winter	≥0. 45	≥0. 45	≥0. 40	—	≥0. 40
	Summer	≤0. 30	≤0. 30	≤0. 30	≤0. 15	≤0. 30

Note: The solar heat gain coefficient is the comprehensive solar heat gain coefficient which includes shading (excluding internal shading).

Table 6. 1. 5-2 External windows of public buildings (including transparent curtain walls) heat transfer coefficient (*K*) and solar heat gain coefficient (*SHGC*)

Performance parameter		Severe cold zone	Cold zone	Hot summer and cold winter zone	Hot summer and warm winter zone	Temperate zone
Heat transfer coefficient K(W/(m^2 · K))		≤1. 2	≤1. 5	≤2. 2	≤2. 8	≤2. 2
Solar heat gain coefficient *SHGC*	Winter	≥0. 45	≥0. 45	≥0. 40	—	—
	Summer	≤0. 30	≤0. 30	≤0. 15	≤0. 15	≤0. 30

Note: The solar heat gain coefficient is the comprehensive solar heat gain coefficient which includes shading (excluding internal shading).

6. 1. 6 The transparent parts of the external doors in severe cold zone and cold zone should comply with the requirements in article 6. 1. 5 of this standard for external windows (including transparent curtain walls); the value of heat transfer coefficient K of opaque part of external door should not be greater than 1. 2 W/(m^2 · K) in severe cold zone and not be greater than 1. 5 W/(m^2 · K) in cold zone.

6. 1. 7 The heat transfer coefficient K of the door for separating heating and non-heating space in severe cold zone should not be greater than 1. 3 W/(m^2 · K), and that of the door for separating heating and non-heating space in cold zone should not be greater than 1. 6 W/(m^2 · K).

6. 1. 8 The hole size of doors and windows shall conform to the requirement of hole size of doors and windows stipulated in the current national standard GB/T 5824 *Size system of opening for windows and doors in building*. The commonly used standard hole size stipulated in the current national standard GB/T 30591 *Requirements for size coordination for opening of windows and doors in building* shall be prioritized.

6. 1. 9 Shading in summer, heating in winter, and daylighting shall be considered comprehensively when selecting the performance of external windows and shading devices.

6. 2 Energy Equipment and Systems

6. 2. 1 When using distributed room air conditioner as the cooling and heating source, the energy consumption efficiency in the cooling season shall comply with the requirements in Table 6. 2. 1.

Table 6.2.1 Energy efficiency indicator of distributed room air conditioner

Type	Seasonal energy efficiency ratio (W·h)/(W·h)
Single cooling type	5.40
Heat pump type	4.50

6.2.2 When using gas-fired boiler for heating and hot water as the heating source, its heat efficiency shall meet the requirements in Table 6.2.2.

Table 6.2.2 Heat efficiency of gas-fired boiler for heating and hot water

Type		Heat efficiency
Household - hot water heating boiler	η_1	99%
	η_2	95%

Note: η_1 is the larger value of two heat efficiency values between rated heat input and partial heat input of the hot water heating boiler (rated heat input in 50% hot water state and rated heat input in 30% heating state), and η_2 is the smaller value between those two.

6.2.3 When air-source heat pump is used as heat source, the coefficient of performance (*COP*) shall meet the requirements in Table 6.2.3.

Table 6.2.3 Coefficient of performance (*COP*) of air-source heat pump

Type	Coefficient of performance *COP* under nominal conditions of low ambient temperature
Hot air type	2.00
Hot water type	2.30

6.2.4 When multi split air conditioning (heat pump) units are used, the integrated part load value *IPLV*(C) or annual performance factor (*APF*) under nominal cooling conditions and specified conditions may be selected according to Table 6.2.4.

Table 6.2.4-1 Integrated part load value of multi split air conditioning (heat pump) units (*IPLV*(C))

Type	Integrated part load value (*IPLV*(C))
Multi split air conditioning (heat pump)	6.0

Table 6.2.4-2 Annual performance factor (*APF*) of multi-connected air conditioning (heat pump) units

Type	Energy efficiency grade (W·h)/(W·h)
Multi-connected air-condition (heat pump)	4.5

6.2.5 When a gas-fired boiler is used, the heat efficiency of the boiler shall meet the requirements in Table 6.2.5 under its nominal working conditions and stipulated conditions.

Table 6.2.5 Heat efficiency of gas-fired boiler

Performance parameter	Boiler rated evaporating capacity D(t/h)/ rated heat power Q (MW)	
	$D \leqslant 2.0/Q \leqslant 1.4$	$D > 2.0/Q > 1.4$
Heat efficiency of boiler	≥92%	≥94%

6.2.6 When a water chilling (heat pump) package using the vapor compression cycle driven by a motor is used, its coefficient of performance (*COP*) or integrated part load value (*IPLV*) may be selected according to Table 6.2.6-1 and Table 6.2.6-2.

Table 6.2.6-1 Refrigerating coefficient of performance (*COP*) of Water Chilling (heat pump) Units

Type	Coefficient of performance *COP*(W/W)
Water cooling	6.00
Air cooling or evaporative cooling	3.40

Table 6.2.6-2 Integrated part load value (*IPLV*) of cold water (heat pump) units

Type	Integrated part load value *IPLV*
Water cooling	7.50
Air cooling or evaporative cooling	4.00

6.2.7 The heat exchange performance of the fresh air heat recovery device shall comply with the following requirements:

1 Sensible heat exchange efficiency shall not be lower than 75%;

2 Total heat exchange efficiency shall not be lower than 70%.

6.2.8 The per unit air volume power consumption of outdoor air in residential buildings shall not be greater than 0.45 W/(m^3 · h), and the per unit air volume power consumption of outdoor air in public buildings shall comply with the relevant requirements of the current national standard GB 50189 *Design standard for energy efficiency of public buildings*.

6.2.9 The one-pass counting efficiency of the air purification device of the outdoor air heat recovery system for fine particles larger than or equal to 0.5μm should be higher than 80% and shall not be lower than 60%.

7 Technical Measures

7.1 Design

Ⅰ Performance-based design method

7.1.1 Performance-based design shall adopt the organization form of collaborative design.

7.1.2 In performance-based design，the building design scheme shall be optimized and decided using energy consumption simulation calculation software and other tools according to indoor environmental parameters and energy efficiency indicator specified in this standard.

7.1.3 Performance-based design should be carried out according to the following procedures：

1 Set indoor environmental parameters and energy efficiency indicators；

2 Formulate the design scheme；

3 Quantitatively analyze and optimize the design scheme using energy consumption simulation software and other tools；

4 Analyze the optimization results and determine if the standards have been reached. If the energy efficiency indicator cannot comply with the determined target requirements，modify the design scheme，and conduct quantitative analysis and optimization，until the target requirements are met；

5 Determine the optimal design scheme；

6 Prepare performance-based design report.

7.1.4 Performance-based design shall take quantitative analysis and optimization as its core. Sensitivity analysis of key parameters of buildings and equipment to building's load and energy consumption shall be carried out. On top of these，technical measures and performance parameters shall be optimized and selected with consideration of all whole-life costs(WLC) and benefits.

Ⅱ City planning and architectural scheme design

7.1.5 The overall planning of cities and buildings shall be conducive to creating a suitable microclimate. Measures such as optimizing the layout of building space，rationally selecting and utilizing landscape and ecological greening shall be taken to enhance natural ventilation and reduce heat island effect in summer，as well as increasing sunlight in winter to avoid the influence of cold wind on buildings. The main direction of the building should be north-south，and the main entrance shall avoid the dominant wind direction in winter.

7.1.6 The architectural scheme design shall be based on the architectural function and environmental resource conditions，taking the climate and environmental adaptability as the principle，aiming at reducing the annual heating and cooling demand，making full use of passive architectural design methods such as daylighting，natural ventilation and building envelope to reduce the energy demand of buildings.

7.1.7 The architectural design should adopt simple building shape，suitable shape coefficient and window-wall ratio，and relatively small ratio of roof light transmission area to other roof areas.

7.1.8 The architectural design shall adopt high-performance building heat preservation and insulation system and high-performance door and window system. The relevant requirements and selection should comply with the requirements in Appendix C and Appendix D in this standard.

7.1.9 Shading design shall be based on the use requirements of the room, window orientation and building safety. Adjustable or fixed shading measures may be adopted. Dimming glass with adjustable solar heat gain coefficient (*SHGC*) may also be used for shading. Adjustable external shading, adjustable mid-set shading or horizontally fixed external shading should be adopted in the (windows) facing south. Adjustable external shading should be adopted for the windows facing east and west.

7.1.10 Daylighting effect shall be considered in the selection of building depth. For rooms with large depth, lighting atrium, lighting shaft, light pipe and other facilities shall be set to improve the daylighting effect.

7.1.11 The underground space should be provided with lighting skylight, lighting side window, sunken square (courtyard), light pipe and other measures to make full use of natural light.

7.1.12 Building photovoltaic integrated system should be adopted in architectural design.

Ⅲ Thermal bridge treatment

7.1.13 During the designing of the building envelope, special design shall be carried out to eliminate or weaken the thermal bridge, and the insulation layer of the building envelope shall be continuous.

7.1.14 Thermal bridge treatment of external wall shall comply with the following requirements:

1 If structural cantilever, extension, etc. are designed, measures should be adopted to ensure that they are disconnected with the main structure.

2 Connection by locking shall be adopted when the external wall insulation is single-layer insulation; staggered joint bonding shall be adopted for double-layer insulation.

3 Molded insulation components should be adopted at the corner.

4 If anchors are used for thermal insulation layer, these anchors shall be fixed using thermal cut-off bridge.

5 Shall avoid fixing guide rails, keels, brackets and other parts that may lead to thermal bridges on the external wall. If fixing is indeed necessary, the anchors of the thermal cut-off bridge shall be embedded in the external wall, and measures such as reducing the contact area, increasing the insulation layer, and using nonmetallic materials should be taken to reduce the heat transfer loss.

6 The diameter of reserved hole of the through-wall pipe should be 100mm greater than the outer diameter of the pipeline.

There should be filled with insulation between the wall structure and the pipes or between the casing and the pipe.

7.1.15 The thermal bridge treatment of external doors and windows and their shading facilities shall comply with the following requirements:

1 The installation method of external doors and windows shall be optimized according to the construction of the wall. If the external insulation system is adopted for the wall, the external doors and windows may be installed with the overall hanging method. The inner surface of the door and window frame should be level with the outer surface of the base wall. , while the doors and windows are in the external insulation layer of the external wall. As for the prefabricated sandwich insulation exterior walls, embedded installation method should be adopted for external doors and windows. The connecting piece between external doors and windows and base wall should be treated by blocking the thermal bridge.

2 The joint between the outer surface of the external doors and windows and the base wall should be sealed with waterproof and vapor-permeable materials. The joint between the inner surface of doors and windows and the base wall shall be sealed with air tightness materials.

3 The external shading design of windows shall be firmly connected connected with the main building structure. The connecting piece between the connecting pieces and base wall shall be treated by blocking the thermal bridge.

7.1.16 Roofing thermal bridge treatment shall comply with the following requirements:

1 Roofing insulation layer shall be continuous with the insulation layer of external wall, structural thermal bridge shall not be allowed; if layered insulation materials are used, it shall be laid out in staggered joints, with bonding between the layers.

2 The waterproof layer shall be set on the outdoor side of the roof insulation layer; on the roof structure layer, vapor barrier shall be set up under the thermal insulation layer; roof vapor barrier design and exhaust structure design shall comply with the current national standard GB 50345 *Technical code for roof engineering*.

3 Parapet and other structures protruding from the roof shall have continuous insulation layer with the insulation layer of roofing and wall surface, without structural thermal bridge. For weak links such as parapet and air outlet of building shafts, metal cover plates should be set to improve their durability. Measures shall be taken to avoid thermal bridges at the connection parts between metal cover plates and structures.

4 The reserved hole of the through-roof pipeline should be larger than the outer diameter of the pipeline by more than 100mm. Pipes extending out of the roof shall be protected by sleeves, while insulation materials shall filled between the sleeves and the pipes.

5 The reserved hole of downspout should be larger than the outer diameter of pipeline by more than 100mm, while the gap between downspout and parapet should filled with foamed polyurethane.

7.1.17 Basement and ground thermal bridge treatment shall comply with the following requirements:

1 The outer insulation layer of basement exterior wall shall be continuous with the insulation layer of the ground part and adopt the insulation material with low water absorption rate; the outer insulation layer of the basement exterior wall shall extend below the underground frozen soil layer, or completely wrap the underground structure; The inside and outside of the insulation layer outside the basement exterior wall should each have a waterproof layer, which shall extend to an appropriate distance above the outdoor ground.

2 If there is no basement, the ground insulation and external wall insulation shall be continuous without thermal bridge.

Ⅳ Air tightness of building envelope

7.1.18 The air tightness layer of building building envelope shall be continuous and surround the whole building envelope. The position of the air tightness layer shall be clearly marked in the architectural design and construction drawing.

7.1.19 When designing the building envelope, special air tightness design shall be carried out.

7.1.20 The external doors and windows with high air tightness shall be selected for architectural design. The gap between the external doors and windows and the openings shall be treated with air tightness.

7.1.21 The design of air tightness layer shall rely on the airtight building envelope layer. Suitable air tightness materials shall be selected.

7.1.22 Detail design shall be carried out at the openings, wire boxes, pipeline penetrations and other parts prone to air tightness problems, with detailed description of air tightness; pre-embedded threading pipe should be adopted for power pipeline penetrating air tightness layer, whereas bridge laying shall not be adopted.

7.1.23 Sealing joints shall be designed at the junctions of different building envelope and at the junctions between exhaust equipment and building envelope, with detailed description of air tightness.

Ⅴ Heating and cooling system

7.1.24 When selecting the cooling and heating sources of the heating and cooling system, the performance parameters shall be optimized, the schemes shall be compared and selected according to the comprehensive economic and technical factors, and the following requirements should be met:

1 If decentralized heating is used in severely cold zones, gas-fired boiler may be used; if centralized heating is adopted, ground source heat pump, industrial waste heat or biomass boiler should be used as heat sources, with low temperature water heating.

2 For cold zone and hot summer and cold winter zone, ground source heat pump or air-source heat pumps should be used.

3 Cooling equipment with higher energy efficiency such as magnetic levitation units should be adopted in hot summer and warm winter zone.

7.1.25 Heating and cooling supply system shall be designed as follows:

1 Products with high energy efficiency shall be prioritized. System energy efficiency shall also be improved.

2 Shall be able to directly or indirectly utilize natural cold sources.

3 Multi-energy supplement and integration optimization shall be considered.

4 Flexible adjustment shall be possible according to the building load.

5 The renewable energy shall beused in priority.

6 Demand for domestic hot water shall be also considered.

7.1.26 Energy-consuming equipment such as circulating pump and fan shall adopt adjustable speed drive system.

7.1.27 According to the cooling and heating load characteristics of the buildings, outdoor air reheating scheme shall be optimized or appropriate dehumidification technical measures shall be taken.

Ⅵ Outdoor air heat recovery and ventilation system

7.1.28 The outdoor air heat recovery system shall be set up. The rationality and reliability of annual operation shall be considered in the design of the outdoor air heat recovery system.

7.1.29 The type of outdoor air heat recovery device selected and adopted in design shall have high energy-saving effect and shall be economical.

7.1.30 The outdoor air heat recovery system should be equipped with air purification device with low-resistance and high-efficiency.

7.1.31 Anti-freezing and anti-frosting measures shall be taken for the outdoor air heat recovery system in severely cold and cold zone.

7.1.32 The outdoor air system of residential buildings should be set up independently for each household, and outdoor air volume supplied shall according to the demand of each dwelling unit.

7.1.33 The outdoor air system should be equipped with a outdoor air bypass duct. If the outdoor temperature and humidity are suitable, the outdoor air may directly enter the room without passing through the heat recovery device.

7.1.34 Heat-insulating motorized dampers shall be set on ducts for outdoor air, exhaust air, and makeup air connected outdoor, linked to the system.

7.1.35 The kitchen of residential buildings should be equipped with independent air supply system, which shall comply with the following requirements:

1 Makeup air should be introduced directly from outside, and the makeup air duct shall be heat preserved. An insulated and sealed motorized dampers shall be set at the entrance and linked to the range hood.

2 The makeup air outlet shall be set as close to the stove as possible.

Ⅶ Lighting and elevator

7.1.36 Energy-efficient light sources and lamps shall be selected. LED light sources are better options.

7.1.37 The elevator system shall adopt an energy-saving control and drag system and comply with the following requirements:

1 If there are two or more elevators arranged in a centralized way, they shall have group control function;

2 If there is no external call and preset command in the elevator car for a period of time, light and fan in the elevator shall be automatically turned off;

3 Adjustablespeed drives system should be adopted, and energy feedback device may be used in the elevator system of high-rise building.

Ⅷ Monitoring and control

7.1.38 The monitoring system of indoor environmental quality and building energy consumption shall be set up to monitor and record the key parameters of the indoor environment and the energy consumption of building classification items. The monitoring system of indoor environmental quality and building energy consumption shall also comply with the following requirements:

1 Public buildings' energy consumption shall be measured by categories and by each utility based on their energy consumption accounting unit and energy consumption system, as well as various energy consumption forms such as cooling, heating and electricity; residential buildings shall measure the main energy consumption systems of public parts by categories, and should measure the energy consumption of heating and cooling, domestic hot water, lighting and sockets of typical households individually. The number of households to be measured should not be less than 5 households and no less than 2% of the total number of the same type of residential unit.

2 The indoor environment of the main functional space of the building shall be monitored. The monitoring should be done by layers, directions, and types for public buildings for residential buildings, no less than 5 households and no less than 2% of the total number of same type of typical households'indoor environment should be monitored.

3 If renewable energy is used, it shall be measured separately.

4 Special energy-using units such as data center, canteen, and boiling water room shall be measured independently.

5 The energy consumption of key energy-using equipment or systems, such ascooling and heating sources, transmission and distribution systems and lighting systems shall be measured with priority.

6 Meteorological parameters such as outdoor temperature and humidity and solar irradiance should be monitored.

7 The number of users in public buildings should be recorded.

7.1.39 Building automatic control system shall be set up. The building's automatic control system shall automatically adjust the operating conditions of main supply equipment and systems according to the terminal use requirements of cooling, heat and water.

7.1.40 Intelligent lighting control system shall be adopted for building's lighting.

7.1.41 Energy-saving control should take the main room or functional area as the control unit to realize the overall integration and optimal control of HVAC and lighting and shading, and should have the following functions:

1 Integrate and collect physical quantities related to indoor environment control, such as temperature, humidity, air quality, illumination, information of human body in room, etc.;

2 Include shading control, lighting control, cooling, heating and outdoor air terminal equipment control of the room, with optimizing linkage control in between;

3 Under the precondition of meeting the requirements of indoor environmental parameters, (energy-saving control) shall aim to reduce the comprehensive energy consumption of the room by automatically determining the room control mode, or by executing different space scene mode control schemes according to user instructions.

7.1.42 If there are multiple sources of energy supply, optimization control shall be carried out with regard to factors such as system energy efficiency comparison. When adopting renewable energy system, priority shall be given to the use of renewable energy.

7.1.43 The operation control of outdoor air units shall comply with the following requirements:

1 Should be able to start-stop equipment, adjust fan speed and the opening ofoutdoor air valve correspondingly with regard to indoor carbon dioxide concentration changes;

2 Should set a differential pressure sensor to detect the changes of filter differential pressure;

3 Should control the bypass valve of theoutdoor air heat recovery device with regard to the minimum economic temperature difference (enthalpy difference), or link to and open the external window for natural ventilation;

4 The outdoor air heat recovery device in severely cold and cold zones shall have anti-freezing protection function;

5 Convenient Human-Machine Interface (HMI) such as touch screen and mobile operating software should be provided.

7.2 Construction Quality Control

7.2.1 The construction company shall formulate special construction plans for key parts such as thermal bridge treatment and guarantee of air tightness and conduct on-site practical operation demonstration.

7.2.2 During the construction the insulation work of building envelope, supplementary thermal insulation materials supplied in package and professional construction technology shall be selected. For external insulation structure system, weather resistance of external insulation system shall be included as an inspection item in its inspection report.

7.2.3 The insulation construction of the building envelope shall comply with the following requirements:

1 Insulation construction shall be carried out after applying basic treatment, installing structural embedded parts and that the result from these two procedures has been examined and deemed as acceptable. Before the construction of external wall insulation, external doors and windows shall be installed and tested first.

2 Insulation layer shall be pasted flat and seamless, and its fixing method shall not produce thermal bridge. The width of rock wool belt should not be less than 200mm if the external thermal insulation system adopted thin plaster of rock wool belt.

3 Overhanging components on the building envelope, pipelines and casings passing through walls and out of the roof shall be treated with thermal bridge blocking measures .

4 The vertical and horizontal joints of prefabricated sandwich insulation exterior wall panels shall be treated as thermal bridges blocking measures.

7.2.4 External doors and windows (including skylights) shall enter the construction site as finish unit. Installation of external doors and windows shall comply with the following requirements:

1 Before installation, the structural construction shall be tested as qualified and the openings of doors and windows shall be smooth.

2 External doors and windows and base wall fittings shall be treated by blocking the thermal bridge.

3 Joints between window (door) openings and window (door) frame shall be treated with waterproof sealing.

4 Windows water apron shall be installed at the bottom of the window, and the gap between the ends and bottom of the windowsill board and the insulation layer shall be sealed; drip lines shall be installed above the openings of doors and windows.

7.2.5 If external sunshade is designed, the fixing position of the external sunshade shall be determined after the installation of the external window and before external insulation has been constructed. If the external insulation has not been constructed, the fittings shall be installed. The thermal bridge between the connector and the base wall shall be blocked.

7.2.6 The air tightness treatment of the building envelope shall comply with the following requirements:

1 The quality of air tightness material shall be selected based on the material of the base layer at the pasting position and whether plaster is needed to cover the air tightness material;

2 Gaps in building structuresshall be blocked;

3 Air tightness treatment shall be carried out at the junction of different materials of the building envelope, at air leakage parts such as through-wall and out-of-roof pipeline, and at casing;

4 Air tightness construction shall be carried out after thermal bridge treatment.

7.2.7 The air tightness treatment of prefabricated structure structure shall comply with the following requirements:

1 Cast-in-place concrete sealing method should be adopted for vertical joints of the inner blade plate of the prefabricated shear wall structure of exterior walls. High-strength grouting material shall be used for horizontal joints.

2 Flexible insulation materials should be used to seal the vertical and horizontal joints of the inner blade plate of the outer wall plate in fabricated frame structure. Air tightness treatment shall also be handled at the indoor side.

3 Waterproof and vapor permeable materials should first be set on the surface of sandwich insulation layer at the vertical and horizontal joints of the outer blade plate. Then, full-length polyethylene rods with a diameter slightly larger than the width of the joints shall be filled from the plate joints. Plate joints should be sealed with weather-resistant silicone sealants.

4 The vertical and horizontal joints between prefabricated sandwich exterior wall panels and structural columns and beams shall have waterproof and steam-proof layers installed on the indoor side before being plastered.

7.2.8 During the construction, thermal defects and air tightness tests should be carried out on key parts of thermal bridge and air tightness, where leakage points would be found and shall be repaired in time.

7.2.9 The construction of electromechanical system shall comply with the following requirements:

1 Electromechanical system installation shall avoid producing thermal bridge and destroying airtight layer;

2 Dust prevention shall be done to all open parts of the ventilation system;

3 Noise elimination and vibration isolation treatment shall be done during equipment installation and pipeline construction.

7.2.10 When main materials and equipment come onto the site, quality inspection shall be carried out to see if they comply with the design requirements. Main materials and equipment should include the followings:

1 Heat insulation material;

2 External doors and windows, building curtain wall (including daylighting roof) and external shading facilities;

3 Waterproof and vapor permeable materials and air tightness materials;

4 Heating and air conditioning system equipment;

5 Lighting equipment;

6 Solar heat utilization or solar photovoltaic power generation system equipment, etc.

7.2.11 Each process of the construction shall be inspected upon handing over to the next process, where the next process may only be carried on after the previous process passes the inspection. The concealed work of construction record and image data shall be generated. The concealed work inspection shall cover the following items:

1 External wall base course and its surface treatment, laying mode, thickness of thermal insulation layer and gap filling of plates; anchors installation and thermal bridge treatment; grid cloth laying; thermal insulation and sealing treatment of through-wall pipeline, etc.

2 Roofing, ground base and its surface treatment, laying mode and thickness of thermal insulation layer and filling quality of plate gap; waterproof layer (steam proof and permeability) setting; treatment of rainwater inlet parts, out-of-roof pipes and through-ground pipes, etc.

3 Installation method of doors, windows and sunshade system; thermal bridge blocking measures of joints between door and window frames and wall structures; air tightness treatment around the window frame, thermal bridge measures between connectors and base wall, etc.

4 Construction practices of key parts, such as, parapet, window frame, closed balcony, overhanging components, embedded brackets, etc.

7.2.12 After the constructing of main building body, finishing the installation of doors and windows, internal and external plastering, and before the start of fine decoration, the building air tightness test shall be carried out based on the requirements of Appendix E of this standard. The testing results shall meet the air tightness indicator requirements of this standard.

7.2.13 After the construction of equipment system, joint commissioning and debugging shall be carried out, and the energy-saving performance of heating, ventilation, air conditioning and lighting system and the performance of renewable energy system shall be tested. The testing results shall meet the design requirements of this standard.

7.3 Operation and Management

7.3.1 The building operation management unit shall formulate a special operation management plan for the adjustment and control of high-performance building envelope, outdoor air heat recovery system, and building energy consumption system, as well as preparing the corresponding operation management manual.

7.3.2 On the premise of ensuring the safety of equipment and meeting the design parameters of indoor environment, the operation scheme that is most beneficial to building energy conservation shall be selected in the operation and management of the building, and the following requirements shall be met:

1 The operation scheme shall be based on architectural design and make full use of the functions of building components and equipment to control and adjust;

2 Dynamic operation strategy adjustment shall be made based on outdoor meteorological parameters and actual use of buildings.

7.3.3 During the first year after the building is officially put into use, the building energy system shall be adjusted. The debug of the system shall comply with the following requirements:

1 It shall cover the main seasonal working conditions and partial load working conditions;

2 The central control system and all energy-using systems and building components working in linkage shall be covered;

3 The system adjustment should continue until the end of the third complete year of official usage;

4 In the process of building use, if the use function of the building changes greatly or the energy-using system is reformed, the system shall be readjusted in the first year after the building is restored to use.

7.3.4 In the process of building use, key parts such as the insulation system and air tightness guarantee of the building building envelope shall be maintained and inspected, and the following requirements shall be met:

1 Avoid fixing objects on external walls or roofs, so that the integrity of insulation systems would be protected; if fixing is indeed necessary, measures must be taken to prevent thermal bridges.

2 Attention shall be paid to whether the plastering layer on the inner surface of the outer wall, the waterproof vapor barrier layer on the roof and the sealing strip of the outer window are in good condition and whether the air tightness layer is damaged. In case of air tightness damage, the sealing strip shall be repaired or replaced in time.

3 Regular check shall be done on whether the external doors and windows are closed tightly, whether the insulating glass leaks, and whether the hardware parts such as locks are loose and worn. Every year, the movable parts and easily worn parts of doors and windows shall be maintained.

4 If the openings of doors and windows or other air tightness parts of buildings are reconstructed or constructed, the buildings'air tightness shall be measured again after completion.

5 The thermal performance ofbuilding envelope should be inspected regularly, and the parts with obvious thermal performance decline shall be rectified in time.

7.3.5 In the process of building use, the operation strategy or use mode shall be adjusted with regard to the building energy consumption data, building usage records, and meteorological data. If necessary, the building energy system shall be readjusted.

7.3.6 The outdoor air system should be closed and natural ventilation shall be adopted during transition season. The operation management of outdoor air unit shall comply with the following requirements:

1 Clean up or replace the filter device in time based on the change of pressure difference on both sides of the filter.

2 Check the performance of the heat recovery device every two years. If necessary, replace the heat recovery device in time to ensure the heat recovery efficiency.

3 When the heating and cooling equipment is turned on, the bypass valve of the outdoor air heat recovery device should control its opening based on the temperature or enthalpy difference that generate minimum cost.

7.3.7 The building operation management unit shall record and analyze the building operation parameters and shall comply with the following requirements:

1 In addition to complying with the requirements of this standard when recording various energy consumption data, it is also necessary to record the personnel usage and outdoor environmental parameters of the building in the same period;

2 The building operation data shall be analyzed every year, and shall be compared with the corresponding data of the previous year in the longitudinal direction, or with the operation data of nearly zero energy building with the same climate zone and the same function in the horizontal direction;

3 Energy consumption data should be released to the public.

7.3.8 The construction operation management unit shall compile the user manual, which shall then be publicized to owners and users so that they can follow through. In public space, a bulletin board shall be set up to notify the users of precautions related to energy saving.

8 Evaluation

8.1 General Requirements

8.1.1 An evaluation shall be done on nearly zero energy building that would run through the whole process of design, construction and operation.

8.1.2 Each building shall be evaluated individually.

8.1.3 Evaluation by categories shall be carried out according to the requirements of energy efficiency indicator in chapter 5 of this standard, and shall meet the following requirements:

1 If the energy efficiency indicator of nearly zero energy building does not reach the standard, an evaluation of buildings with ultra-low energy consumption shall be carried out;

2 When the energy efficiency indicator is above the requirements of article 5.0.5, subclause 2, or article 5.0.6, subclause 2 of this standard for nearly zero energy building, an evaluation of zero energy consumption buildings shall be carried out.

8.1.4 The evaluation and calculation of energy efficiency indicator for each building shall adopt calculation software with the same performance design.

8.2 Evaluation Method and Judgment

8.2.1 After the construction drawing design documents are reviewed and approved, the accounting of construction drawing review and building energy efficiency indicator shall be conducted, where the following requirements shall be met:

1 Construction drawing reviewing shall focus on checking the construction and practice of key nodes ofthe Building envelope, and the following requirements shall be met:

1) The key construction and working details of building envelope shall comply with the requirements of thermal insulation and air tightness;

2) Outdoor air heat recovery system shall be adopted.

2 Residential buildings shall calculate the annual energy consumption from heating, annual energy consumption from cooling, the utilization rate of renewable energy and building energy consumption, and shall comply with the requirements of chapter 4 and 5 of this standard.

3 Public buildings shall calculate the energy saving rate of the building body, the utilization rate of renewable energy, and building energy saving rate, and shall comply with the requirements of chapter 4 and 5 of this standard.

8.2.2 Before building is examined for completion, the following contents shall be evaluated:

1 The air tightness of buildings shall be tested, and the testing methods and results shall comply with the requirements of Appendix E of this standard.

2 The building envelope shall be tested for thermal defects, and the increase of the ratio of energy consumption caused by defected area on the tested inner surface shall be less than 5%, where a single defected area shall be smaller than $0.3m^2$. If the testing result of the inner surface meets this requirement, it shall be deemed as qualified. Otherwise, it shall be regarded as unqualified.

3 The performance of the outdoor air heat recovery device shall be tested where the following requirements shall be met:

1) For heat recovery devices with rated air volume greater than 3000m³/h, an on-site testing shall be conducted. The testing method and result shall comply with the requirements specified in Appendix F of this standard.

2) For heat recovery devices with rated air volume less than or equal to 3000m³/h, spot check shall be conducted and the devices shall be sent to the laboratory for testing. The sampling number of the same model and specification products shall not be less than 1; the testing method shall comply with the current national standard GB/T 21087 *Air-to-air energy recovery equipment*, and the testing results shall comply with the requirements of Appendix F of this standard. Products that have obtained high-performance energy-saving identification (or certification) and are within the validity period of identification (or certification) may exempt from spot inspection if certificates are provided.

4 Spot testing on key products (parts) such as exterior wall insulation materials, doors, and windows shall be conducted according to the current national standard GB 50411 *Standard for acceptance of energy efficient building construction*, and their performance shall comply with the design requirements. Products that have obtained high-performance energy-saving identification (or certification) and are within the validity period of identification (or certification) may exempt from spot inspection if certificates are provided.

5 If the factors affecting building energy consumption change during the construction stage, the energy efficiency indicator shall be re-calculated based on the requirements of subclause 2 and 3 of article 8.2.1 of this standard.

8.2.3 After the building is put into normal use for one year, indoor environment testing and operation energy efficiency indicator evaluation shall be conducted for public buildings, and indoor environment testing and operation energy efficiency indicator evaluation should be conducted for residential buildings.

8.2.4 Indoor environmental testing parameters shall include indoor temperature, humidity, temperature of the thermal bridge inner surface, outdoor air volume, indoor $PM_{2.5}$ content, and indoor environmental noise; the indoor environment detection parameters of public buildings should also include CO_2 concentration and indoor illumination. Testing result shall comply with the design requirements.

8.2.5 The energy efficiency indicator calculation shall comply with the following requirements:

1 The evaluation time period shall be one year;

2 Public buildings shall take the building energy saving rate as the evaluation indicator, and shall directly adopt the energy consumption data measured by each utility function, and adopt its measuring instruments after checking;

3 Residential buildings shall take the building energy consumption as the evaluation indicator, and take the measured data of electricity meters, gas meters and other measuring instruments of buildings or typical users as the basis, which will be adopted after calculation and analysis.

8.2.6 If it meets the requirements of article 8.2.1 of this standard, it may be decided that the architectural design meets the requirements of this standard. Also, it may be decided that the building meets the requirements of this standard if it meets the requirements of article 8.2.1 and 8.2.2 of this standard.

Appendix A Calculation Method of Energy Efficiency

A.1 General Requirements

A.1.1 The energy efficiency calculation software shall be capable to:

1 Calculate the load formed by the heat transfer of building envelope (including thermal bridge), the solar radiation heat gain, the indoor heat gain and the ventilation heat loss, taking into account the influence of building's thermal inertia on load;

2 Calculate more than 10 building partitions;

3 Calculate the energy consumption of building heating, ventilation, air conditioning, lighting, domestic hot water and elevator system, and the utilization and power generation of renewable energy system;

4 Support monthly average dynamic calculation method;

5 Calculate the impact of outdoor air heat recovery and air tightness on building energy consumption.

A.1.2 The energy efficiency calculation shall comply with the following requirements:

1 Meteorological parameters shall be selected according to the current professional standard JGJ/T 346 *Standard for weather data of building energy efficiency*.

2 The annual heating demand and annual cooling demand shall include the heat loss of building envelope and the heat (or cold) demand for handling outdoor air; the heat (cold) demand for handling outdoor air shall be deducted from the heat (or cold) recovered from the exhaust air.

3 If the outdoor temperature is ≤28℃ and the relative humidity is ≤70%, natural ventilation shall be used and the cooling demand of the building is not calculated.

4 The impact of partial load and intermittent use shall be considered if calculating the energy consumption of heating, ventilation and air conditioning system.

5 The calculation of lighting energy consumption shall consider the influence of daylighting and automatic control.

6 The consumption of renewable energy shall be calculated.

A.1.3 Calculation parameter setting of design building energy efficiency shall comply with the following requirements:

1 The shape, size, orientation, internal space division and use function, building structure size, heat transfer coefficient of building envelope, practices, solar heat gain coefficient of external windows (including transparent curtain wall), area ratio of window to wall and roof window opening area shall be consistent with the architectural design documents.

2 Except for the non-heating and cooling areas specified in the design documents, the building functional areas shall be counted as including the heating and cooling areas; operation time of heating and cooling system shall be set according to Table A.1.3-1.

Table A.1.3-1 Daily operation time of buildings

Category		System working time
Residential building	Whole year	0:00—24:00

Table A. 1. 3-1 (Continued)

Category		System working time
Office building	Workday	8:00—18:00
	Festival and holiday	—
Hotel building	Whole year	0:00—24:00
School building	Workday	8:00—18:00
	Festival and Holiday	—
Shopping mall building	Whole year	9:00—21:00
Cinema	Whole year	9:00—21:00
Hospital building	Whole year	8:00—18:00

3 If the design building adopts movable sunshade device, the sunshade coefficient in heating season and cooling season shall be determined according to Table A. 1. 3-2.

Table A. 1. 3-2 Value of sunshade coefficient *SC* of movable sunshade device

Control mode	Heating season	Cooling season
Manual control	0. 80	0. 40
Automatic control	0. 80	0. 35

4 The personnel density and occupancy rate of room, the power density and utilization rate of electrical equipment, and the lighting opening time shall be set according to Table A. 1. 3-3, and the outdoor air opening rate shall be calculated according to the personnel occupancy rate.

Table A. 1. 3-3 Internal heat settings of personnel, equipment and lighting in different types of rooms

Building type	Room type	Per capita floor area (m^2)	Room occupancy rate of personnel	Equipment power density (W/m^2)	Equipment utilization rate	Lighting power density (W/m^2)	Lighting on time (h/month)
Residential building	Sitting room	32	19. 5%	5	39. 4%	6	180
	Bedroom	32	35. 4%	6	19. 6%	6	180
	Dining room	32	19. 5%	5	39. 4%	6	180
	Kitchen	32	4. 2%	24	16. 7%	6	180
	Rest room	0	16. 7%	0	0. 0%	6	180
	Staircase	0	0. 0%	0	0. 0%	0	0
	Lobby foyer	0	0. 0%	0	0. 0%	0	0
	Storage room	0	0. 0%	0	0. 0%	0	0
	Garage	0	0. 0%	0	0. 0%	2	120
Office building	Office room	10	32. 7%	13	32. 7%	9	240
	Dense office	4	32. 7%	20	32. 7%	15	240
	Conference Room	3. 33	16. 7%	5	61. 8%	9	180
	Lobby foyer	20	33. 3%	0	0. 0%	5	270
	Lounge	3. 33	16. 7%	0	0. 0%	5	150
	Equipment room	0	0. 0%	0	0. 0%	5	0
	Storehouse and pipeline shaft	0	0. 0%	0	0. 0%	0	0
	Garage	100	25. 0%	15	32. 7%	2	270

Table A. 1. 3-3 (Continued)

Building type	Room type	Per capita floor area (m^2)	Room occupancy rate of personnel	Equipment power density (W/m^2)	Equipment utilization rate	Lighting power density (W/m^2)	Lighting on time (h/month)
Hotel building	Hotel room (below three-star)	14. 29	41. 7%	13	28. 8%	7	180
	Hotel room (three-star)	20	41. 7%	13	28. 8%	7	180
	Hotel room (four-star)	25	41. 7%	13	28. 8%	7	180
	Hotel room (five-star)	33. 33	41. 7%	13	28. 8%	7	180
	Multi-function hall	10	16. 7%	5	61. 8%	13. 5	150
	General stores and supermarkets	10	16. 7%	13	54. 2%	9	330
	Expensive shop	20	16. 7%	13	54. 2%	14. 5	330
	Chinese restaurant	4	16. 7%	0	0. 0%	9	300
	Western-style restaurant	4	16. 7%	0	0. 0%	6. 5	300
	Hotpot restaurant	4	16. 7%	0	0. 0%	8	300
	Fast food restaurant	4	16. 7%	0	0. 0%	5	300
	Bar, teahouse	4	36. 6%	0	0. 0%	8	300
	Kitchen	10	27. 9%	0	0. 0%	6	330
	Swimming pool	10	26. 3%	0	0. 0%	14. 5	210
	Garage	100	32. 7%	15	32. 7%	2	270
	Office room	10	32. 7%	13	32. 7%	8	330
	Dense office	4	32. 7%	20	32. 7%	13. 5	330
	Conference room	3. 33	36. 5%	5	61. 8%	9	270
	Lobby foyer	20	54. 6%	0	0. 0%	9	300
	Lounge	3. 33	36. 5%	0	0. 0%	5	120
	Equipment room	0	0. 0%	0	0. 0%	5	0
	Storehouse and pipeline shaft	0	0. 0%	0	0. 0%	0	0
	Fitness center	8	26. 3%	0	0. 0%	11	210
	Bowling room	8	40. 4%	0	0. 0%	14. 5	240
	Billiard room	4	40. 4%	0	0. 0%	14. 5	240
School building	Classroom	1. 12	26. 8%	5	14. 9%	9	180
	Reading room	2. 5	26. 8%	10	14. 9%	9	180
	Computer equipment room	4	50. 4%	40	100. 0%	15	300
	Office room	10	32. 7%	13	32. 7%	8	270
	Dense office	4	32. 7%	20	32. 7%	13. 5	270
	Conference Room	3. 33	36. 5%	5	61. 8%	8	120
	Lobby foyer	20	54. 6%	0	0. 0%	10	270
	Lounge	3. 33	36. 5%	0	0. 0%	5	240
	Equipment room	0	0. 0%	0	0. 0%	5	0
	Storehouse and pipeline shaft	0	0. 0%	0	0. 0%	0	0
	Garage	100	32. 7%	15	32. 7%	2	240
Shopping mall building	General stores and supermarkets	2. 5	32. 6%	13	54. 2%	10	330
	Expensive shop	4	32. 6%	13	54. 2%	16	330

Table A. 1. 3-3 (Continued)

Building type	Room type	Per capita floor area (m^2)	Room occupancy rate of personnel	Equipment power density (W/m^2)	Equipment utilization rate	Lighting power density (W/m^2)	Lighting on time (h/month)
Shopping mall building	Chinese restaurant	2	27. 9%	0	0. 0%	9	300
	Western-style restaurant	2	36. 6%	0	0. 0%	6. 5	300
	Hotpot restaurant	2	17. 7%	0	0. 0%	5	300
	Fast food restaurant	2	27. 9%	0	0. 0%	5	300
	Bar, teahouse	2	36. 6%	0	0. 0%	8	300
	Kitchen	10	27. 9%	0	0. 0%	6	300
	Office rooms	10	32. 7%	13	32. 7%	8	240
	Dense office	4	32. 7%	20	32. 7%	13. 5	240
	Conference room	3. 33	36. 5%	5	61. 8%	8	180
	Lobby foyer	20	54. 6%	0	0. 0%	10	270
	Lounge	3. 33	36. 5%	0	0. 0%	5	120
	Equipment room	0	0. 0%	0	0. 0%	5	0
	Storehouse and pipeline shaft	0	0. 0%	0	0. 0%	0	0
Cinema	Cinema	1	34. 6%	0	0. 0%	11	390
	Stage metaphor	5	34. 6%	40	66. 7%	11	390
	Ballroom	2. 5	35. 8%	30	35. 8%	11	240
	Chess & card room	2. 5	20. 8%	0	0. 0%	11	240
	Shop, exhibition hall	5	23. 8%	20	41. 7%	9	300
Hospital building	Ward	10	100. 0%	0	0. 0%	5	210
	Operation room	10	52. 9%	0	0. 0%	20	390
	Waiting room	2	47. 9%	0	0. 0%	6. 5	270
	Outpatient office	6. 67	47. 9%	0	0. 0%	6. 5	270
	Nursery	3. 33	100. 0%	0	0. 0%	6. 5	270
	Drug storehouse	0	0. 0%	0	0. 0%	5	270
	Archives storeroom	0	0. 0%	0	0. 0%	5	270
	Beauty parlor	4	51. 7%	5	51. 7%	8	270

5 The lighting power density of the lighting system shall be consistent with the architectural design documents.

6 The system form and energy efficiency of heating, ventilation, air conditioning, domestic hot water and elevator system shall be consistent with the design documents; the water consumption of domestic hot water system shall be consistent with the design documents, and shall comply with the current national standard GB 50555 *Standard for water saving design in civil building*.

7 The form and efficiency of renewable energy system shall be consistent with the design documents.

A. 1. 4 Calculation parameter setting of reference building energy efficiency shall comply with the following requirements:

1 The shape, size, internal space division, use function, building structure and building envelope of the building shall be consistent with the design of the building.

2 Operation time of cooling and heating system, indoor temperature, lighting switch time, elevator system operation time, per capita occupancy area and occupancy rate of rooms, outdoor air volume of personnel, operation schedule of outdoor air units, power density and utilization rate of electrical equipment shall be consistent with the design building; the lighting power density value shall be determined according to Table A. 1. 3-3 of this standard.

3 The thermal performance and cold and heat source performance of the building envelope of public buildings shall comply with the national standard GB 50189－2015 *Design standard for energy efficiency of public buildings*. The thermal performance and cold/heat source performance of residential buildings envelope shall comply with the professional standards JGJ 26－2010 *Design standard for energy efficiency of residential buildings in severe cold and cold zones*, JGJ 134－2016 *Design standard for energy efficiency of residential buildings in hot summer and cold winter zones* and JGJ 75－2012 *Design standard for energy efficiency of residential buildings in hot summer and warm winter zone*. The unspecified parameters of thermal performance and cold/heat source performance of building envelope shall be consistent with the design building.

4 The reference building model shall be established according to the actual orientation of the design building, and the reference building load shall be calculated by taking the average value of the calculation results of the model load in four different directions, where the building is rotated 90°, 180° and 270° in turns.

5 The reference building has no movable sunshade device, and the area ratio of window to wall of the reference building shall be selected according to Table A. 1. 4-1. For building types not included in the table, the window-wall ratio of the reference building shall be consistent with the design building.

Table A. 1. 4-1 Area ratio of window to wall of reference building

Building type	Area ratio of window to wall (%)
Retail supermarket	7
Hospital	27
Hotel building (room number ≤75)	24
Hotel building (room number > 75)	34
Office building (area ≤ 10000m²)	31
Office building (area >10000m²)	40
Catering building	34
Shopping mall building	20
School building	25
Residential building	35

6 The form of heating and cooling system of the reference building shall be determined according to Table A. 1. 4-2; the domestic hot water system form and water consumption quota of the reference building shall be consistent with the design building. The heat source is gas boiler whose energy efficiency requirements shall be consistent with the requirements of heat source in the reference standard.

Table A.1-4-2 Forms of heating and cooling system in reference buildings

Building type		Severe cold zone	Cold zone	Hot summer and cold winter zone	Hot summer and warm winter zone	Temperate zone
Residential building	End form	Radiator heating, split-type air conditioner	Radiator heating, split-type air conditioner	Split-type air conditioner	Split-type air conditioner	Split-type air conditioner
	Cold source	Split-type air conditioner	Split-type air conditioner	Split-type air conditioner	Split-type air conditioner	Split-type air conditioner
	Heat source	Coal-fired boiler	Coal-fired boiler	Air source heat pump	Air source heat pump	Air source heat pump
Office building	End form	Radiator heating, fan coil unit	Radiator heating, fan coil unit	Fan coil unit	Fan coil unit	Fan coil unit
	Cold source	Electric refrigeration unit	Electric refrigeration unit	Electric refrigeration unit	Electric refrigeration unit	Electric refrigeration unit
	Heat source	Coal-fired boiler	Coal-fired boiler	Gas boiler	Gas boiler	Gas boiler
Hotel building	End form	Radiator heating, fan coil unit	Fan coil unit	Fan coil unit	Fan coil unit	Fan coil unit
	Cold source	Electric refrigeration unit	Electric refrigeration unit	Electric refrigeration unit	Electric refrigeration unit	Electric refrigeration unit
	Heat source	Coal-fired boiler	Coal-fired boiler	Gas boiler	Gas boiler	Gas boiler
School building	End form	Radiator heating, split-type air conditioner	Radiator heating, split-type air conditioner	Split-type air conditioner	Split-type air conditioner	Split-type air conditioner
	Cold source	Split-type air conditioner	Split-type air conditioner	Split-type air conditioner	Split-type air conditioner	Split-type air conditioner
	Heat source	Coal-fired boiler	Coal-fired boiler	Air source heat pump	Air source heat pump	Air source heat pump
Shopping mall building	End form	Radiator heating, All-air CAV air conditioning system	All-air CAV air conditioning system	All-air CAV air conditioning system	All-air CAV air conditioning system	All-air CAV air conditioning system
	Cold source	Electric refrigeration unit	Electric refrigeration unit	Electric refrigeration unit	Electric refrigeration unit	Electric refrigeration unit
	Heat source	Coal-fired boiler	Coal-fired boiler	Gas boiler	Gas boiler	Gas boiler

Table A. 1-4-2 (Continued)

Building type		Severe cold zone	Coldz one	Hot summer and cold winter zone	Hot summer and warm winter zone	Temperate zone
Hospital building	End form	Radiator heating, All-air system	All-air system	All-air system	All-air system	All-air system
	Cold source	Electric refrigeration unit	Electric refrigeration unit	Electric refrigeration unit	Electric refrigeration unit	Electric refrigeration unit
	Heat source	Coal-fired boiler	Coal-fired boiler	Gas boiler	Gas boiler	Gas boiler
Others Type	End form	Radiator heating, fan coil unit	Fan coil unit	Fan coil unit	Fan coil unit	Fan coil unit
	Cold source	Electric refrigeration unit	Electric refrigeration unit	Electric refrigeration unit	Electric refrigeration unit	Electric refrigeration unit
	Heat source	Coal-fired boiler	Coal-fired boiler	Gas boiler	Gas boiler	Gas boiler

7 The elevator system form, type, number, design speed, and rated number of passengers of the reference building shall be consistent with the design building. The energy demand (output) of the elevator during standby is 200W, and the specific energy consumption during operation is 1.26 mWh/(kg • m).

A.1.5 Building energy consumption shall be calculated as follows:

$$E = E_{\mathrm{E}} - \frac{\sum E_{\mathrm{r},i} \times f_i + \sum E_{\mathrm{rd},i} \times f_i}{A} \qquad \text{(A. 1. 5)}$$

where, E——the building energy consumption, kWh/(m^2 • a);

E_{E}——the building energy consumption without renewable energy, kWh/(m^2 • a);

A——the usable area within the building suite for residential buildings; the building area for public buildings, m^2;

f_i——the energy conversion coefficient of type l energy selected according to Table A. 1. 11 of this standard;

$E_{\mathrm{r},i}$——the renewable energy power generation of type l annual body , kWh;

$E_{\mathrm{rd},i}$——the renewable energy power generation of type l around the year, kWh.

A.1.6 Building energy consumption without renewable energy generation shall be calculated as follows:

$$E_{\mathrm{E}} = \frac{E_{\mathrm{h}} \times f_i + E_{\mathrm{c}} \times f_i + E_l \times f_i + E_{\mathrm{w}} \times f_i + E_{\mathrm{e}} \times f_i}{A} \qquad \text{(A. 1. 6)}$$

where, E_{h}——the annual energy consumption of heating system, kWh;

E_{c}——the annual energy consumption of cooling system, kWh;

E_l——the annual energy consumption of lighting system, kWh;

E_w —— the annual energy consumption of domestic hot water system, kWh;

E_e —— the annual energy consumption of elevator system, kWh.

A.1.7 The utilization rate of renewable energy shall be calculated as follows:

$$REP_p = \frac{EP_h + EP_c + EP_w + \Sigma E_{r,i} \times f_i + \Sigma E_{rd,i} \times f_i}{Q_h + Q_c + Q_w + E_l \times f_i + E_e \times f_i} \quad \text{(A.1.7)}$$

where, REP_p —— the utilization ratio of renewable energy, %;

EP_h —— the renewable energy utilization in heating system, kWh;

EP_c —— the renewable energy utilization in cooling system, kWh;

EP_w —— the renewable energy utilization in domestic hot water system, kWh;

Q_h —— the annual heating demand, kWh;

Q_c —— the annual cooling demand, kWh;

Q_w —— the annual heat consumption of domestic hot water, kWh.

A.1.8 The utilization of renewable energy in heating system shall be calculated as follows:

$$EP_h = EP_{h,geo} + EP_{h,air} + EP_{h,sol} + EP_{h,bio} \quad \text{(A.1.8-1)}$$

$$EP_{h,geo} = Q_{h,geo} - E_{h,geo} \quad \text{(A.1.8-2)}$$

$$EP_{h,air} = Q_{h,air} - E_{h,air} \quad \text{(A.1.8-3)}$$

$$EP_{h,sol} = Q_{h,sol} \quad \text{(A.1.8-4)}$$

$$EP_{h,bio} = Q_{h,bio} \quad \text{(A.1.8-5)}$$

where, $EP_{h,geo}$ —— the annual renewable energy utilization of ground source heat pump heating system, kWh;

$EP_{h,air}$ —— the annual renewable energy utilization of air source heat pump heating system, kWh;

$EP_{h,sol}$ —— the annual renewable energy utilization of solar hot water heating system, kWh;

$EP_{h,bio}$ —— the annual renewable energy utilization of biomass heating system, kWh;

$Q_{h,geo}$ —— the annual heating capacity of ground source heat pump system, kWh;

$Q_{h,air}$ —— the annual heating capacity of air source heat pump system, kWh;

$Q_{h,sol}$ —— the annual energy supply of solar hot water system, kWh;

$Q_{h,bio}$ —— the annual heating capacity of biomass heating system, kWh;

$E_{h,geo}$ —— the annual heating power consumption of ground source heat pump unit, kWh;

$E_{h,air}$ —— the annual heating power consumption of air source heat pump unit, kWh.

A.1.9 The utilization of renewable energy in domestic hot water system shall be calculated as follows:

$$EP_w = EP_{w,geo} + EP_{w,air} + EP_{w,sol} + EP_{w,bio} \quad \text{(A.1.9-1)}$$

$$EP_{w,geo} = Q_{w,geo} - E_{w,geo} \quad \text{(A.1.9-2)}$$

$$EP_{w,air} = Q_{w,air} - E_{w,air} \quad \text{(A.1.9-3)}$$

$$EP_{w,sol} = Q_{w,sol} \quad \text{(A.1.9-4)}$$

$$EP_{w,bio} = Q_{w,bio} \quad \text{(A.1.9-5)}$$

where, $EP_{w,geo}$ —— the annual renewable energy utilization of domestic hot water system using ground source heat pump, kWh;

$EP_{w,air}$ —— the annual renewable energy utilization of domestic hot water system using air source heat pump, kWh;

$EP_{w,sol}$——the annual renewable energy utilization of domestic hot water system using solar source, kWh;

$EP_{w,bio}$——the annual renewable energy utilization of biomass domestic hot water system, kWh;

$Q_{w,geo}$——the annual domestic hot water heat supply of ground source heat pump system, kWh;

$Q_{w,air}$——the annual domestic hot water heat supply of air source heat pump system, kWh;

$Q_{w,sol}$——the domestic hot water heat provided by solar energy system, kWh;

$Q_{w,bio}$——the annual domestic hot water heat supply of biomass domestic hot water system, kWh;

$E_{w,geo}$——the annual power consumption of ground source heat pump unit for domestic hot water, kWh;

$E_{w,air}$——the annual power consumption of air source heat pump unit for domestic hot water, kWh.

A.1.10 The utilization of renewable energy in the cooling system shall be calculated as follows:

$$EP_{c} = EP_{c,sol} \tag{A.1.10-1}$$

$$EP_{c,sol} = Q_{c,sol} \tag{A.1.10-2}$$

where, $EP_{c,sol}$——the annual renewable energy utilization of solar-source cooling system, kWh;

$Q_{c,sol}$——the annual cooling capacity of solar-source cooling system, kWh.

A.1.11 Energy conversion coefficient shall meet the requirements of Table A.1.11.

Table A.1.11 Energy conversion coefficient

Energy type	Conversion unit	Energy conversion factor
Standard coal	$kWh/kgce_{terminal}$	8.14
Natural gas	$kWh/m^3_{terminal}$	9.85
Heating power	$kWh/kWh_{terminal}$	1.22
Electricity	$kWh/kWh_{terminal}$	2.6
Biomass	$kWh/kWh_{terminal}$	0.20
Electricity (photovoltaic, wind and other renewable energy power generation)	$kWh/kWh_{terminal}$	2.6

A.2 Residential Buildings

A.2.1 The energy efficiency of residential buildings shall be based on the usable area in the dwelling unit.

A.2.2 The usable area in the dwelling unit shall comply with the following requirements:

1 The usable area in the dwelling unit shall be equal to the sum of usable areas of all functional spaces with heating or air conditioning facilities in the building suite, including the sum of usable areas of bedroom, living room (hall), dining room, kitchen, bathroom, lobby, aisle, storeroom, wall cabinet and balcony with heating or air conditioning facilities.

2 The use area of each functional space shall be equal to the horizontal projection area of the space enclosed by the inner surface of each functional space wall.

3 The stairs in the duplex apartment shall be counted in the usable area of the suite by summing up the usable areas of its natural floors.

4 The space for setting heating or air conditioning facilities in the sloping roof shall be counted in the usable area of the suite. The space where the clear height between the lower surface of the roof panel and the ground floor in the sloping roof is less than 1.2m is not to be calculated as the usable area; the usable area of the suite shall be calculated as 1/2 of the space with clear height of 1.2m ~ 2.1m; all spaces with a clear height exceeding 2.1m shall be counted in the usable area of the suite.

5 Chimneys, ventilation ducts, tube wells, etc. shall not be counted as the usable area in the dwelling unit.

A.3 Public Building

A.3.1 If calculating the energy saving rate of the building body, the building energy consumption of the design building shall not include the renewable energy generation, and shall be calculated as follows:

$$\eta_e = \frac{|E_E - E_R|}{E_R} \times 100\% \tag{A.3.1}$$

where, η_e —— the building energy efficiency improve-merit rate;

E_E —— the building energy consumption without renewable energy in the design building, kWh/m^2;

E_R —— the building energy consumption of reference building, kWh/m^2.

A.3.2 The calculation of building energy saving rate shall be calculated as follows:

$$\eta_p = \frac{|E_D - E_R|}{E_R} \times 100\% \tag{A.3.2}$$

where, η_p —— the building energy saving rate;

E_D —— the building energy consumption of the design building, kWh/m^2.

Appendix B Energy Consumption of Nearly Zero Energy Public Buildings

B. 0. 1 The building energy consumption of nearly zero energy public building may be selected according to Table B. 0. 1.

Table B. 0. 1 Building energy consumption of nearly zero energy public building (kWh/(m² • a))

City	Small office building	Large office building	Small hotel building	Large hotel building	Shopping mall building	Hospital building	School building	
							Teaching Building	Library
Harbin	64	75	69	84	113	119	64	65
Shenyang	58	70	66	80	113	114	63	61
Beijing	59	73	71	85	127	123	74	65
Zhumadian	57	76	75	90	139	128	82	70
Shanghai	57	79	78	96	148	135	87	74
Wuhan	55	75	77	90	148	131	81	71
Chengdu	55	75	76	87	149	135	86	73
Shaoguan	60	84	86	104	172	148	98	81
Guangzhou	65	92	95	119	197	173	112	94
Kunming	42	58	60	67	113	104	54	54

Note: The data in the table are determined based on the calculation of typical buildings, in which small office buildings and small hotel buildings are slab buildings with a building area of less than 10000m², and other types of buildings are typical buildings with a building area of more than 20000m².

B. 0. 2 The equivalent power consumption of nearly zero energy public buildings may be selected according to Table B. 0. 2.

Table B. 0. 2 Equivalent power consumption of nearly zero energy public buildings (kWh/(m² • a))

City	Small office building	Large office building	Small hotel building	Large hotel building	Shopping mall building	Hospital building	School building	
							Teaching building	Library
Harbin	24	29	26	32	43	46	24	25
Shenyang	22	27	26	31	44	44	24	24
Beijing	23	28	27	33	49	47	28	25
Zhumadian	22	29	29	35	54	49	31	27
Shanghai	22	30	30	37	57	52	34	28
Wuhan	21	29	30	35	57	50	31	27
Chengdu	21	29	29	34	57	52	33	28
Shaoguan	23	32	33	40	66	57	38	31
Guangzhou	25	35	37	46	76	66	43	36
Kunming	16	22	23	26	43	40	21	21

Notes: 1. The data in the table are determined based on the calculation of typical buildings, in which small office buildings and small hotel buildings are slab buildings with a building area of less than 10000m², and other types of buildings are typical buildings with a building area of more than 20000m²;

2. The data in the table is the equivalent energy consumption of building heating, ventilation, air conditioning, lighting, domestic hot water, elevator system and the utilization and power generation of renewable energy system.

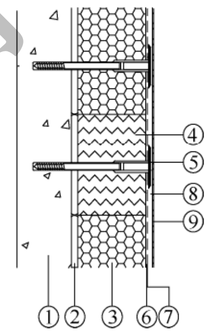
Appendix C　Building Envelope Insulation and Construction Practices

C. 0. 1　The external wall of the building should adopt the structural form of external wall insulation or sandwich insulation structure. Under special conditions, other insulation structures may also be adopted, and heavy building envelopes shall be adopted.

C. 0. 2　If external insulation is adopted, the fire-proof performance of external wall insulation system and the setting of fire-proof isolation belt shall comply with the current national standards GB 50016 *Code for fire protection design of buildings* and JGJ 289 *Technical specification for fire barrier zone of external thermal insulation composite system on walls*.

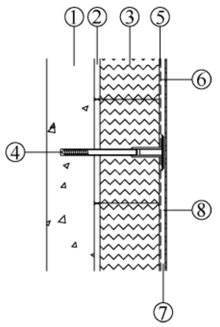
C. 0. 3　The basic structure of organic insulation board thin plastering external insulation system with fire-proof isolation belt should be set according to Table C. 0. 3.

Table C. 0. 3　Basic structure of organic insulation board thin plastering external insulation system

Base wall	Basic structure								Schematic diagram of structure
	Bonding course	Thermal insulation layer		Auxiliary connector	Plastering layer			Surface layer	
①	②	Insulation board ③	Fire-proof isolation belt ④	⑤	Bottom layer ⑥	Reinforced materials ⑦	Surface course ⑧	⑨	
Concrete wall, bricking-up	Adhesive	Organic insulation board, fire-proof isolation belt		Anchors	Plastering glue	Glass fiber mesh	Plastering glue	Coating, facing mortar, etc.	

C. 0. 4　The combustion performance grade of inorganic thermal insulation materials for wall external thermal insulation system shall not be lower than A2 grade, and the basic structure of typical inorganic thermal insulation board thin plaster external thermal insulation system should be set according to Table C. 0. 4.

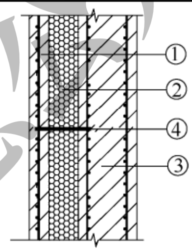
Table C. 0. 4　Basic structure of thin plastering external insulation system for inorganic insulation board

Base wall	Basic structure							Schematic diagram of structure
	Bonding course	Thermal insulation layer	Plastering layer				Surface layer	
①	②	③	Auxiliary connections ④	Bottom layer ⑤	Reinforced materials ⑥	Surface layer ⑦	⑧	
Concrete wall, bricking-up	Adhesive	Inorganic insulation board	Anchors	Plastering glue	Glass fiber mesh	Plastering glue	Coating, facing mortar, etc.	

C. 0. 5　The external thermal insulation system should adopt light finishing layer. The external insulation system with area density exceeding 30kg/m^2 shall be provided with brackets, which shall weaken the thermal bridge effect.

C.0.6 The basic structure of sandwich wall insulation system should be set according to Table C.0.6.

Table C.0.6 Basic structure of sandwich wall insulation system

Basic structure				Schematic diagram of structure
Outer blade plate ①	Thermal insulation layer ②	Inner blade plate ③	Drawing parts ④	
Concrete wall slab	Thermal insulation slab	Concrete wall slab	High strength plastic components or assemblies	

C.0.7 Physical performance indicators of thermal insulation materials for external wall thermal insulation system shall comply with the requirements of Table C.0.7.

Table C.0.7 Physical performance indicator of thermal insulation materials for external wall thermal insulation system

Material type	S. N.	Parameter	Technical requirements
Expanded polystyrene board	1	Thermal conductivity(25℃), W/(m·K)	≤0.037
	2	Apparent density, kg/m^3	18～22
	3	Tensile strength perpendicular to face of the slab, MPa	≥0.10
	4	Dimensional stability, %	≤0.3
	5	Water absorption rate (volume fraction), %	≤2
Graphite polystyrene board	1	Thermal conductivity(25℃), W/(m·K)	≤0.032
	2	Apparent density, kg/m^3	18～22
	3	Tensile strength perpendicular to face of the slab, MPa	≥0.10
	4	Dimensional stability, %	≤0.3
	5	Water absorption rate (volume fraction), %	≤2
Rock wool belt	1	Moisture absorption rate, %	≤0.5
	2	Short-term water absorption (partial immersion), kg/m^2	≤0.5
	3	Thermal conductivity(25℃), W/(m·K)	≤0.044
	4	Tensile strength perpendicular to face, MPa	≥0.15
	5	Acidity coefficient	≥1.8
Vacuum insulation board	1	Thermal conductivity(25℃), W/(m·K)	≤0.008
	2	Penetration strength, N	≥18
	3	Tensile strength perpendicular to face, kPa	≥80
	4	Compressive strength, kPa	≥100
	5	Surface water absorption, g/m^2	≤100
	6	Expansion rate perpendicular to the plate surface after puncture, %	≤10
Polyurethane board	1	Apparent density of core material, kg/m^3	≥35
	2	Thermal conductivity of core material (25℃), W/(m·K)	≤0.024
	3	Dimensional stability of core material (70℃,48h), %	≤1.0
	4	Water absorption rate (volume fraction), %	≤2
	5	Tensile strength perpendicular to face of the slab, MPa	≥0.10

Appendix D Design Selection and Thermal Performance of External Doors and Windows

D. 0. 1 The thermal performance of building external windows and glass doors may be selected according to Table D. 0. 1.

Table D. 0. 1 For thermal performance of external windows

S. N.	Name	Glass configuration	Heat transfer coefficient K[W/ (m^2 · K)]	Solar heat gain coefficient $SHGC$
1	65 series inner casement heat insulation aluminum alloy window	5+12A+5	2. 8～3. 0	0. 48～0. 53
2	65 series inner casement heat insulation aluminum alloy window	5+12A+5Low-E	2. 2～2. 4	0. 35～0. 39
3	65 series inner casement heat insulation aluminum alloy window	5+12Ar+5Low-E	2. 1～2. 3	0. 35～0. 39
4	70 series inner casement heat insulation aluminum alloy window	5+2A+5+12A+5Low-E	1. 8～2. 0	0. 30～0. 37
5	70 series inner casement heat insulation aluminum alloy window	5+12Ar+5+12Ar+5Low-E	1. 7～1. 9	0. 30～0. 37
6	70 series inner casement heat insulation aluminum alloy window	5+12A+5Low-E+12A+5Low-E	1. 6～1. 8	0. 24～0. 31
7	70 series inner casement heat insulation aluminum alloy window	5+12Ar+5Low-E+12Ar+5Low-E	1. 5～1. 7	0. 24～0. 31
8	80 series inner casement heat insulation aluminum alloy window	5+12Ar+5+12Ar+5Low-E	1. 3～1. 5	0. 30～0. 37
9	80 series inner casement heat insulation aluminum alloy window	5+12Ar+5Low-E+12Ar+5Low-E	1. 1～1. 3	0. 24～0. 31
10	90 series inner casement heat insulation aluminum alloy window	5+12A+5+V+5Low-E	0. 9～1. 1	0. 35～0. 39
11	90 series inner casement heat insulation aluminum alloy window	5ultra clear+12A+5ultra clear+V+5ultra clear Low-E	0. 9～1. 1	0. 43～0. 50

Table D. 0. 1 (Continued)

S. N.	Name	Glass configuration	Heat transfer coefficient K[W/ (m^2 · K)]	Solar heat gain coefficient *SHGC*
12	100 series inner casement heat insulation aluminum alloy window	5+12Ar+5Low-E+12Ar+5Low-E	0. 9～1. 1	0. 24～0. 31
13	100 series inner casement heat insulation aluminum alloy window	5ultra clear+12Ar+5ultra clear Low-E+12Ar+5ultra clear Low-E	0. 9～1. 1	0. 40～0. 47
14	100 series inner casement heat insulation aluminum alloy window	5+12Ar+5+V+5Low-E	0. 8～1. 0	0. 35～0. 39
15	100 series inner casement heat insulation aluminum alloy window	5ultra clear+12Ar+5ultra clear+V+5ultra clear Low-E	0. 8～1. 0	0. 43～0. 50
16	65 series inner casement plastic window	5+12A +5	2. 4～2. 6	0. 48～0. 53
17	65 series inner casement plastic window	5+12Ar+5	2. 3～2. 5	0. 48～0. 53
18	65 series inner casement plastic window	5+12A+5+12A+5	1. 8～2. 0	0. 44～0. 48
19	65 series inner casement plastic window	5+12A+5Low-E	1. 8～2. 0	0. 35～0. 39
20	65 series inner casement plastic window	5+12Ar+5Low-E	1. 7～1. 9	0. 35～0. 39
21	65 series inner casement plastic window	5+12A+5+12A+5Low-E	1. 4～1. 6	0. 30～0. 37
22	65 series inner casement plastic window	5+12Ar+5+12Ar+5Low-E	1. 3～1. 5	0. 30～0. 37
23	65 series inner casement plastic window	5+12A+5Low-E+12A+5Low-E	1. 2～1. 4	0. 24～0. 31
24	65 series inner casement plastic window	5+12Ar+5Low-E+12Ar+5Low-E	1. 1～1. 3	0. 24～0. 31
25	82 series inner casement plastic window	5+12Ar+5+12Ar+5Low-E	1. 0～1. 2	0. 30～0. 37
26	82 series inner casement plastic window	5+12Ar+5Low-E+12Ar+5Low-E	0. 8～1. 0	0. 24～0. 31
27	82 series inner casement plastic window	5ultra clear +12Ar+5ultra clear Low-E+12Ar+5ultra clear Low-E	0. 8～1. 0	0. 40～0. 47
28	82 series inner casement plastic window	5+12Ar+5Low-E+V+5	0. 6～0. 8	0. 35～0. 39
29	82 series inner casement plastic window	5ultra clear+12Ar+5ultra clear+V+5ultra clear Low-E	0. 6～0. 8	0. 43～0. 50

Table D. 0. 1 (Continued)

S. N.	Name	Glass configuration	Heat transfer coefficient K[W/ (m² • K)]	Solar heat gain coefficient *SHGC*
30	68 series inner casement wooden windows	5+12A +5	2. 4～2. 6	0. 48～0. 53
31	68 series inner casement wooden windows	5+12Ar+5	2. 3～2. 5	0. 48～0. 53
32	68 series inner casement wooden windows	5+12A+5+12A+5	1. 8～2. 0	0. 44～0. 48
33	68 series inner casement wooden windows	5+12A+5Low-E	1. 8～2. 0	0. 35～0. 39
34	68 series inner casement wooden windows	5+12Ar+5Low-E	1. 7～1. 9	0. 35～0. 39
35	78 series inner casement wooden windows	5+12A+5+12A+5Low-E	1. 4～1. 6	0. 30～0. 37
36	78 series inner casement wooden windows	5+12Ar+5+12Ar+5Low-E	1. 3～1. 5	0. 30～0. 37
37	78 series inner casement wooden windows	5+12A+5Low-E+12A+5Low-E	1. 2～1. 4	0. 24～0. 31
38	78 series inner casement wooden windows	5+12Ar+5Low-E+12Ar+5Low-E	1. 1～1. 3	0. 24～0. 31
39	78 series inner casement wooden windows	5ultra clear+12Ar+5ultra clear Low-E+12Ar+5ultra clear Low-E	1. 1～1. 3	0. 40～0. 47
40	78 series inner casement wooden windows	5+12A+5+V+5Low-E	0. 7～1. 0	0. 30～0. 37
41	78 series inner casement wooden windows	5ultra clear+12Ar+5ultra clear+V+5ultra clear Low-E	0. 7～1. 0	0. 43～0. 50
42	86 series inner casement aluminum-wood composite windows	5+12A +5	2. 5～2. 7	0. 48～0. 53
43	86 series inner casement aluminum-wood composite windows	5+12Ar+5	2. 4～2. 6	0. 48～0. 53
44	86 series inner casement aluminum-wood composite windows	5+12A+5+12A+5	1. 9～2. 1	0. 44～0. 48
45	86 series inner casement aluminum-wood composite windows	5+12A+5Low-E	1. 9～2. 1	0. 35～0. 39
46	86 series inner casement aluminum-wood composite windows	5+12Ar+5Low-E	1. 8～2. 0	0. 35～0. 39
47	86 series inner casement aluminum-wood composite windows	5+12A+5+12A+5Low-E	1. 5～1. 7	0. 30～0. 37
48	86 series inner casement aluminum-wood composite windows	5+12Ar+5+12Ar+5Low-E	1. 4～1. 6	0. 30～0. 37

Table D. 0. 1 (Continued)

S. N.	Name	Glass configuration	Heat transfer coefficient K[W/ (m^2 · K)]	Solar heat gain coefficient *SHGC*
49	86 series inner casement aluminum-wood composite windows	5+12A+5Low-E+12A+5Low-E	1. 3~1. 5	0. 24~0. 31
50	86 series inner casement aluminum-wood composite windows	5+12Ar+5Low-E+12Ar+5Low-E	1. 2~1. 4	0. 24~0. 31
51	92 series inner casement aluminum-wood composite windows	5+12Ar+5 Low-E+12Ar+5Low-E	0. 9~1. 1	0. 24~0. 31
52	92 series inner casement aluminum-wood composite windows	5ultra clear+12Ar+5ultra clear Low-E+12Ar+5ultra clear Low-E	0. 9~1. 1	0. 40~0. 47
53	92 series inner casement aluminum-wood composite windows	5+12A+5+V+5Low-E	0. 8~1. 0	0. 30~0. 37
54	92 series inner casement aluminum-wood composite windows	5ultra clear+12Ar+5ultra clear+V+5ultra clear Low-E	0. 8~1. 0	0. 43~0. 50

Notes: 1. Glass configuration is expressed in the order of outdoor side to indoor side; the hollow glass membrane layer of double Low-E is generally located on the 2nd and 4th sides or the 3rd and 5th sides; the vacuum glass in the vacuum composite hollow glass shall be located at the indoor side, and the Low-E membrane is generally located at the 4th side.

2. If the width of plastic profile is ≥82mm, it shall have 6 chambers or more. The heat insulation strip's section height of 80 series aluminum alloy profiles is larger than 44mm, section height of 90 series is larger than or equal to 44mm, section height of 100 series is larger than or equal to 64ram, and the middle cavity of insulation strips needs to be filled with foam material. Aluminum-wood composite window refers to the Type b stated in the current national standard GB/T 29734. 1 *Energy-saving windows and doors for buildings Part 1: Aluminum-wood complex windows and doors*, that is, the wood profile-framed aluminum-wood composite window.

D. 0. 2 The thermal performance of the external windows shall be subject to the testing value.

Appendix E Testing Method of Building Envelope Air Tightness

E.1 Testing Method

E.1.1 Differential pressure method should be adopted for building's air tightness testing.

E.1.2 The testing using differential pressure method shall measure the building's air exchange rate under the differential pressure of 50Pa and −50Pa, and quantify the overall air tightness performance of the building envelope of nearly zero energy building by calculating the air exchange rate.

E.1.3 If using differential pressure method to test the air tightness of building, the following requirements shall be met:

1 Before the testing, all doors and windows connected to the outside world shall be closed, the leakage sources of non-building envelopes such as floor drains and air vent shall be blocked, and ventilation equipment such as ventilation fans and air conditioners shall be closed at the same time;

2 Infrared thermal imager or smoke generator should be used to determine the leakage source of the building;

3 Sealing treatment shall be done at the part where the testing device is connectedto the building;

4 When measuring the differential pressure between inside and outside the building, the indoor and outdoor air temperature and outdoor atmospheric pressure shall be recorded at the same time. Testing data shall also be remediated afterwards.

E.1.4 The calculation of building's air tightness testing results shall meet the following requirements:

1 The air change rate under the differential pressure of 50pa and −50Pa shall be calculated as follows:

$$N_{50}^{+} = L_{50}^{+}/V \quad \text{(E.1.4-1)}$$

$$N_{50}^{-} = L_{50}^{-}/V \quad \text{(E.1.4-2)}$$

where, N_{50}^{+}, N_{50}^{-}——the room's air change rate under the indoor and outdoor differential pressure of 50Pa and −50Pa, h^{-1};

L_{50}^{+}, L_{50}^{-}——the average air flow under the indoor and outdoor differential pressure of 50Pa and −50Pa, m^3/h;

V——the ventilation volume of the measured room or building, m^3.

2 The air exchange rate of the building or the measured space shall be calculated as follows:

$$N_{50} = (N_{50}^{+} + N_{50}^{-})/2 \quad \text{(E.1.4-3)}$$

where, N_{50}——the air exchange rate of the building or room under the indoor and outdoor differential pressure of 50Pa, h^{-1}.

E.1.5 For residential buildings, the air tightness performance shall be carried out at individual buildings or typical households, and take the volume weighted average of the testing results as the air change rate of the whole building. For public buildings, the whole building shall be tested on air tightness performance, where the testing results will be taken as the air change rate of the whole building.

E.2 Qualification Indicators and Judgment Methods

E.2.1 Building's air tightness indicator shall comply with the requirements of air tightness indicators in clause 5 of this standard.

E.2.2 If the testing results meet the requirements of article E.2.1 of this standard, it shall be determined as qualified.

Appendix F　On-site Testing Method for Heat Recovery Efficiency of Outdoor Air Heat Recovery Device

F.1　Testing Method

F.1.1　The heat recovery performance testing of the outdoor air heat recovery device shall be carried out under the actual operation status of the system.

F.1.2　The on-site testing of heat recovery performance of outdoor air heat recovery device shall comply with the following requirements:

1　Before testing, temperature and humidity detection instruments with automatic recording function shall be set on the outdoor air pipe and exhaust pipe entering and leaving the outdoor air heat recovery device;

2　The ratio of the total air volume of the exhaust system of the outdoor air heat recovery unit to the total air volume of the outdoor air system shall be 90% ~ 100% during the testing period, and the air volume testing shall be carried out with regard to the relevant requirements of the current professional standard of JGJ/T 177 *Standard for energy efficiency test of public buildings*;

3　Testing shall be carried out after the stable operation of the system, and the testing time should not be less than two hours.

F.1.3　The exchange efficiency of outdoor air heat recovery device is an important indicator for evaluating heat recovery performance. The temperature exchange efficiency, humidity exchange efficiency and enthalpy exchange efficiency of the outdoor air heat recovery unit shall be calculated as follows:

$$\eta = \frac{X_{xj} - X_{xc}}{X_{xj} - X_{pj}} \times 100\% \tag{F.1.3}$$

where, η——exchange efficiency [temperature: ℃, humidity: %, enthalpy: H];

X_{xj}——the parameter of outdoor air intake;

X_{xc}——the parameter of outdoor air outlet;

X_{pj}——the parameter of exhaust air intake.

F.2　Acceptance Criteria and Judgment Methods

F.2.1　The heat recovery performance of the outdoor air heat recovery device shall comply with the design requirements; if there are no requirements in the design, it shall comply with the requirements of article 6.2.7 of this standard.

F.2.2　If the testing results meet the requirements of article F.2.1 of this standard, it shall be determined as qualified.

Explanation of Wording in This Standard

1 Words used for different degrees of strictness are explained as follows in order to mark the differences in executing the requirements in this standard:

1) Words denoting a very strict or mandatory requirement:
"Must" is used for affirmation; "must not" for negation;

2) Words denoting strict requirement under normal conditions:
"Shall" is used for affirmation; "shall not" for negation;

3) Words denoting a permission of a slight choice or an indication of the most suitable choice when conditions permit:
"Should" is used for affirmation; "should not" for negation;

4) "May" is used as word denoting a permission of choice or an indication of the most suitable choice when conditions permit.

2 "Shall comply with..." or "shall meet the requirements of..." is used in this standard to indicate that it is necessary to comply with the requirements stipulated in other relative standards and codes.

List of Quoted Standards

1. GB 50016 *Code for fire protection design of buildings*
2. GB 50118 *Code for design of sound insulation of civil buildings*
3. GB 50189 *Design standard for energy efficiency of public buildings*
4. GB 50345 *Technical code for roof engineering*
5. GB 50411 *Standard for acceptance of energy efficient building construction*
6. GB 50555 *Standard for water saving design in civil building*
7. GB 50736 *Design code for heating ventilation and air conditioning of civil buildings*
8. GB/T 5824 *Size system of opening for windows and doors in building*
9. GB/T 21087 *Air-to-air energy recovery equipment*
10. GB/T 29734.1 *Energy-saving windows and doors for buildings Part 1: Aluminum-wood complex windows and doors*
11. GB/T 30591 *Requirements for size coordination for opening of windows and doors in building*
12. JGJ 26－2010 *Design standard for energy efficiency of residential buildings in severe cold and cold zones*
13. JGJ 75－2012 *Design standard for energy efficiency of residential buildings in hot summer and warm winter zone*
14. JGJ 134－2016 *Design standard for energy efficiency of residential buildings in hot summer and cold winter zones*
15. JGJ/T 177 *Standard for energy efficiency test of public buildings*
16. JGJ 289 *Technical specification for fire barrier zone of external thermal insulation composite system on walls*
17. JGJ/T 346 *Standard for weather data of building energy efficiency*