

NATIONAL STANDARD
OF THE PEOPLE'S REPUBLIC OF CHINA
中华人民共和国国家标准

**Code for Design of Building Water
Supply and Drainage**

建筑给水排水设计规范

GB 50015 — 2003

(英文版)

Chief Editorial Department: Shanghai Construction and Management Committee
Approval Department: Ministry of Construction of the People's Republic of China
Executive Date: September 1, 2003

China Architecture & Building Press

中国建筑工业出版社

Beijing 2003

NOTICE

This code is written in Chinese and English. The Chinese text shall be taken as the ruling one in the event of any inconsistency between the Chinese text and the English text.

Bulletin of Ministry of Construction of the People's Republic of China

No. 138

Bulletin of Ministry of Construction of the People's Republic of China Promulgation for the National Standard "Code for Design of Building Water Supply and Drainage"

"Code for Design of Building Water Supply And Drainage" has been approved as a national standard, with a serial number of GB 50015—2003, and it shall come into force upon September 1, 2003. Herein, No. 3.2.1, 3.2.3, 3.2.4, 3.2.5, 3.2.6, 3.2.9, 3.2.10, 3.2.14, 3.5.8, 3.9.1, 3.9.3, 3.9.4, 3.9.9, 3.9.12, 3.9.14, 3.9.22, 3.9.24, 3.9.27, 4.2.6, 4.3.5, 4.3.6, 4.3.13, 4.3.19, 4.5.9, 4.8.4, 4.8.8, 5.4.5, 5.4.20 are mandatory clauses, which must be enforced strictly. The original "Code for Design of Building Water Supply and Drainage" GBJ 15—88 shall be abrogated on the same date.

Research Institute of Standards and Norms-Ministry of Construction will organize the China Planning Press to take on publishing and distributing works of this code.

Ministry of Construction of the People's Republic of China
April 15, 2003

Preface

According to the requirements of "Notice of Printing and Distributing for the '1998 Preparation and Revision Plan of Engineering Construction Standards' (Document JB[1998] No. 94)-Ministry of Construction", that the "Code for the Design of Building Water Supply and Drainage" GBJ 15—88 managed by Shanghai Construction and Management Committee, compiled by Shanghai Xian Dai Architectural Design(Group) Co., Ltd jointly with China Architecture Design & Research Group and Architectural Design and Research Institute of Guangdong Province has been revised completely. In the period of revision, the Code revision group summarized the recent design experience of building water supply and drainage, carried out various studies on major topic, proposed the draft for comments, based on the nation-wide opinions which solicited by the code revision group from specialist, scholar, designer of the Design, the Research and College relevant units, finally, the new version of code was worked out through serious study and analysis.

The major revisions of technology are (1) residential area water supply and drainage design has been added; (2) dwelling and public buildings rated water consumption has been readjusted and added; (3) the measures to prevent pollution in pipe connect have been added; (4) applied technology of new types of pipe has been added; (5) probability formula of calculating second flow of domestic water supply has been adopted; (6) hydraulic calculation of varied types of pipe has been unified; (7) recycle water treatment of aquatic recreation pool has been added; (8) the design for cooling water and recycle water has been added; (9) details of hospital sewage, water supply and drainage for swimming pool expressed in association standards have been deleted, only provisions of principle, safety and sanitation reserved; (10) the provisions on water supply and drainage for production technology have been deleted; (11) the parameter of pressure flow of roof rainwater has been added; (12) applied range for design heat consumption of maximum hour with central hot water supply has been readjusted; (13) calculation of natural cycle hot water pipe system has been deleted; (14) technology essential and parameter of hot water machine set and water heater have been added and (15) relevant contents of fine drinking water pipe system have been added.

The present code may be in need of locally revised in the future, that the relevant informations and contents of locally revised Clauses will be published on the magazine of "Standardization of Engineering Construction".

Clauses marked with boldface letters in the code are mandatory clauses and must be enforced strictly.

Ministry of Construction is responsible for supervision of the present code and explanation of the mandatory clauses, Shanghai Construction and Management Committee for its specific management and Shanghai Xian Dai Architectural Design (Group) Co., Ltd for its specific explanation. During the process for implementing this code, the relevant opinions and advices, which

can may be available for reference to next revision, can be posted to shanghai Xian Dai Architectual Design(Group) Co., Ltd (Management Group of National Standand“Code for Design of Building Water Supply and Drainage.”, No. 258 Shi Men Er Lu Modern architectural design edifice, Shanghai, China, Postcode:200041).

Chief editorial unit, participating editorial units and main drafting staffs of this code:

Chief editorial unit:

Shanghai Xian Dai Architectural Design (Group) Co., Ltd.

Participating editorial units:

China Architecture Design & Research Group

Architectural Design and Research Institute of Guangdong Province

Main drafting staffs:

Zhang Miao, Liu Zhenyin, He Guanqin, Feng Xudong, Sang Luqing

Translators:

Beijing General Municipal Engineering Design & Research Institute: Peng Ruimin, Pan Jiaduo, Zhai Rongshen

Contents

1 General Principles	1
2 Terms and Symbols	2
2.1 Terms	2
2.2 Symbols	8
3 Water Supply	11
3.1 Rated water consumption and water pressure	11
3.2 Water quality and water quality pollution protection	15
3.3 System selection	17
3.4 Pipe material, fittings and water meter	18
3.5 Piping layout and pipe laying	22
3.6 Design flow and hydraulic calculation of pipe	24
3.7 Water tower, Water tank, Reservoir	30
3.8 Pressurizing equipment, pump house	32
3.9 Swimming pool and aquatic recreation pool	35
3.10 Cooling tower and circulation cooling water	38
3.11 Waterscape	41
4 Water Drainage	43
4.1 Selection of drainage system	43
4.2 Plumbing fixture and water lock	43
4.3 Pipe location and pipelining	45
4.4 Calculation of drainage pipe	48
4.5 Pipe material, fittings and inspection well	52
4.6 Vent pipe	55
4.7 Sewage pump and catch pit	57
4.8 Small domestic soil disposal	58
4.9 Rainwater	62
5 Hot water and drinking water supply	67
5.1 Rated consumption, temperature and quality of hot water	67
5.2 Selection of hot water supply system	71
5.3 Calculation of heat consumption, hot water quantity and heating equipment	
hot supply	73
5.4 Water heating and storage	75
5.5 Calculation of network	81
5.6 Pipe, fitting and pipeline laying	82
5.7 Potable water supply	84

Appendix A	Residential district underground pipeline (structure) minimum net clearance between lines	87
Appendix B	Valves and screw fittings resistance loss converted length of compensation	88
Appendix C	Water supply pipe section Plumbing fixtures water supply equivalent simultaneously outflow probability calculated equation, α_c coefficient values table	89
Appendix D	Water supply pipe section designed second flow calculation table	90
Appendix E	Fine drinking water number of taps simultaneously use in the calculated pipe section	100
Explanation of wording in this Code		101

1 General Principles

1.0.1 The code was drawn up for the purpose of ensuring the quality of building water supply and drainage design, set the design to meet the basic requirement of safety, hygiene, applicability, economy.

1.0.2 The code is applicable to the residential area, civil building water supply and drainage design, and also applicable to the industrial building domestic water and drainage and factory roof rain-fall run-off design.

But when design the following projects, current relevant specified code or regulation must be executed:

- 1** Collapsible loess, perennial frozen soil and expansive soil region building.
- 2** Building with anti-seismic intensity more than 9.
- 3** Mineral water cure, civil air defense works.
- 4** Industrial production water supply and drainage.
- 5** Building reclaimed water.

1.0.3 Building water supply and drainage design must meet the application demands and also provide convenience for construction installation, operation management, maintenance inspection and safety protection.

1.0.4 Building water supply and drainage engineering design must conform with the code, in addition, must conform current relevant national standard codes requirement.

2 Terms and Symbols

2.1 Terms

2.1.1 Potable water

Water quality meets portable water hygienic standard apply to usual drinking and washing water.

2.1.2 Non-drinking water

Water not safe for drinking or for personal or culinary use, apply to wash sanitary fixture, vehicle, road sprinkling, irrigate greenbelt, complement air condition circulating water.

2.1.3 Hourly variation coefficient

Ratio between maximum daily maximum hourly water consumption and average hourly water consumption.

2.1.4 Maximum hourly water consumption

Within maximum daily water consumption day time, the maximum water consumption per hour.

2.1.5 Backflow pollution

1 Due to negative pressure in the pipeline, causing a reversal of flow from water storage tank, plumbing fixture liquid mixture back flow water.

2 Due to non-drinking water or other liquid mixture flow into water supply system.

2.1.6 Air gap

1 The vertical space distance between the lowest point of water supply pipeline outlet and the receptor or fixture which water overflows.

2 The vertical space distance between the lowest point of indirect drainage facility or storage outlet and the receptor or fixture which water overflows.

2.1.7 Flood-level rim

The edge of the receptor or fixture which water overflows.

2.1.8 Service pipe, inlet pipe

This pipe from the water main in the street or municipal pipeline of supply to the building served area.

2.1.9 Building unite pipe

Water supply and drainage pipeline laying around the building directly connect with building inlet and outlet pipe.

2.1.10 Inlet pipe

Pipe between water meter in building and out door building unite pipe.

2.1.11 Vertical division block

The building water supply system is vertically divided into a certain number of blocks.

2.1.12 Parallel water supply

Water supply system in vertical division block with parallel distribution pattern.

2.1.13 Series water supply

Water supply system in vertical division block with series distribution pattern.

2.1.14 Exposed installation

Indoor pipeline with exposed installation.

2.1.15 Concealed installation, embedded installation

Indoor pipeline installed in wall channel/well or pipe duct, or concealed by architectural decoration.

2.1.16 Manifold

A fitting or pipe with many outlets or connections relatively close together.

2.1.17 Compression fitting

Connecting pattern of fitting compressed on pipe with screw and locking nut.

2.1.18 Insert connections

Pipe connection by using special pipe clamp and clamp ring-connecting pattern.

2.1.19 Coefficient of line-expansion

The increase in unit pipeline length for one degree rise in temperature.

2.1.20 Plumbing fixture, fixture

Installed receptacles, device or appliance which are supplied with water or which receive liquid or liquid-borne wastes and discharge such wastes into the drainage system to which they may be directly or indirectly connected.

2.1.21 Fixture unit

Ratio between value of flow (water supply or drainage flow) as a base of some plumbing fixture and other plumbing fixtures value of flow (water supply or drainage flow).

2.1.22 Rate of flow

The quantity of water flows out in a unit time of a plumbing fixture.

2.1.23 Design flow

The average quantity of flow of water supply or water drainage in a certain period, it is the basic design flow of basic of building water supply and drainage pipeline system.

2.1.24 Head loss

The loss of pressure (or water head) in water supply and drainage pipe system.

2.1.25 Pneumatic

Water supply pattern, a composite set of pump and pressure vessel and accessories, water pumps into pressure vessel, the compressed air of vessel automatically regulate the amount of water supply and keep the pressure of water supply.

2.1.26 Points of distribution

Points of water consumption of water supply system.

2.1.27 Circulating period

Ratio between the effective water volume in circulating system structure or the transmission pipeline and circulation capacity per unit of time period.

2.1.28 Backwash

When filter clogging occurs, flash back with comparative high-pressure water flow.

2.1.29 Unassured hour for average year

Yearly average value of accumulated average year unassured total number of hours.

2.1.30 Water quality stabilization treatment

Water treatment process, keep the concentration of calcium carbonate and carbon dioxide in an equilibrium state in the circulating cooling water (neither calcium carbonate deposit nor solution corrosion), and restrain bacteria production.

2.1.31 Cycle of concentration

Ratio of salt concentration between circulating cooling water and the added water.

2.1.32 Self-priming

The top of centrifugal pump with horizontal axis, 1st stage inlet of centrifugal pump with vertical axis with multistage are set below the lowest design starting elevation, start up by gravity flow of water into the pump body.

2.1.33 Waterscape, fountain

Artificial build up waterscape, foundation.

2.1.34 Domestic soil

Residents discharge domestic fecal sewage from ordinary living processes.

2.1.35 Domestic waste water

Residents discharge wash water from ordinary living processes.

2.1.36 Domestic sewage

The water-borne wastes derived from ordinary living processes.

2.1.37 Building drain, outlet pipe

That part of the lowest piping of a discharge system which receives the discharge from soil, waste and other drainage pipes inside the walls of the building and conveys it to the outdoor manhole.

2.1.38 Vertical pipe, riser, stack

Any pipe or fitting which makes an angle of 45° or more with the horizontal.

2.1.39 Horizontal pipe

Any pipe or fitting which makes an angle of less than 45° with the horizontal.

1 Horizontal branch

Pipe section which connects fixture drain to vertical pipe.

2 Horizontal main

Pipe section which connects a number of vertical pipes to drain pipe.

2.1.40 Cleanout

Fitting for inside pipe cleaning installed on horizontal drain pipe.

2.1.41 Checkhole, checkpipe

Fitting with openable cover set on vertical drain pipe and comparatively long horizontal pipeline for inspection and cleaning.

2.1.42 Trap, water-sealed joint

A fitting or device which provides a liquid seal to prevent the emission of sewer gasses without materially affecting the flow of sewage or waste water through it.

2.1.43 Water seal

An installation with a certain height water column to prevent air release from drainage pipe system into the rooms.

2.1.44 H pipe

H type fitting for connection vertical drain pipe and vent pipe.

2.1.45 Vent pipe, vent

Part of the vent system for drainage system air circulation, stable pressure, prevent the failure of water seal.

2.1.46 Vent stack

Vertical vent pipe installed to provide circulation of air to and from the drainage system and which extends through one or more stories.

2.1.47 Specific vent stack

Vertical vent stack only connect with vertical drain pipe, for the air circulation of vertical drain pipe.

2.1.48 Vent headers

Vent pipe section connect with several vent stacks or vertical drain top vent section and stretch out door into open air.

2.1.49 Main vent stack

Vertical pipeline connected with loop vent pipe and vertical drain pipe for air circulation of drain branch and drain vertical pipe.

2.1.50 Secondary vent stack, assistant vent stack

Vent stack only connect with loop vent, for air circulation of drain horizontal branch.

2.1.51 Loop vent

Vent pipe section of drain branch connected with several plumbing fixture from the lower end of first plumbing fixture to the main vent stack or assistant vent stack.

2.1.52 Fixture vent

Pipe section from the outlet of the trap of plumbing fixture to the vent stack.

2.1.53 Yoke vent, yoke vent pipe

Pipe section connecting the drain vertical pipe to the vent stack.

2.1.54 Indirect drain

Drain pipe of fixture or vessel connect indirectly with drainage system, there keep an air gap.

2.1.55 Buried depth

Vertical distance between buried pipe top to the ground surface.

2.1.56 Angle of turning flow

Angle between original flow direction and turning flow direction.

2.1.57 Depth ratio

Degree of fullness of water flow in the conduit, indicated by ratio between water depth and pipe diameter in pipe, or ratio between water depth and the designed water depth in conduit.

2.1.58 Grease interceptor

Small treatment structure for intercept, collect grease from domestic waste water.

2.1.59 Cooling tank

Treatment structure to decrease temperature of drain water.

2.1.60 Septic tank

A receptacle which receives the discharge of a drainage system for retain solid, digest organic matter through a period of detention and allow the liquid to discharge into the outside soil pipe.

2.1.61 Reclaimed water

Effluent from a waste water treatment plant that has undergone external treatment to remove harmful pathogens, organic material and heavy metals.

2.1.62 Hospital sewage

Polluted drainage water from hospital.

2.1.63 Primary treatment

Mechanical treatment, waste water primary treated by mechanical measures.

2.1.64 Secondary treatment

Composite of mechanical treatment and biochemical or chemical treatment for waste water treatment process.

2.1.65 Air change

Ratio between volume of draw in or blow-off the ventilation system within a unit of time and volume of room space.

2.1.66 Rainfall intensity

Rainfall in a unit of time, usually expressed as mm/min(or L/s.ha).

2.1.67 Recurrence interval

Through static analysis of long time observed rainfall record, equal or greater than some storm intensity rainfall occur once average interval time, the expressed unit is usually in year.

2.1.68 Duration of rainfall

Any continuous time section of rainfall duration, the expressed unit is usually in min.

2.1.69 Inlet time

Time of rainwater from correspond catchment area farthest spot surface flow into drain pipe inlet, the expressed unit is usually in min, abbreviated inlet time.

2.1.70 Time of flow

Time of rainwater flow in the pipe, the expressed unit is usually in min, abbreviated time of flow.

2.1.71 Catchment area

Drain conduit for rainfall catchment area, expressed unit usually in m^2 of ha.

2.1.72 Gravity storm system

Based on gravity flow design of roof rainwater drainage system.

2.1.73 Pressure storm system

Based on pressure flow design of roof rainwater drainage system.

2.1.74 Gully hole, gutter inlet

Ground surface rainwater inlet well with gully gratings and frames.

2.1.75 Down pipe, leader

Down pipe installed on inside or outside building wall applied to drain roof rainwater.

2.1.76 Hanged pipe

Horizontal pipe hang on building floor, beam or roof truss.

2.1.77 Rain strainer

A receptor facility receives roof surface rainwater flow into down pipe.

2.1.78 Runoff coefficient

Ratio between volume of certain catchment rainwater and volume of rainfall water.

2.1.79 Central hot water supply system

Hot water supply system for one set or many set building.

2.1.80 Local hot water supply system

A small hot water supply system used only to supply single or several point of distribution.

2.1.81 Open system for hot water supply

Hot water pipe system is open to the air in the hot water supply system.

2.1.82 Closed system for hot water supply

Hot water pipe system is closed to the air in the hot water supply system.

2.1.83 One-pipeline hot water system

Hot water system with one pipe supply, one temperature, no water temperature regulation of the rater use spot.

2.1.84 Source of heat

Energy for heating hot water.

2.1.85 Heat medium

Heat transmission carrier for heat-supply system. Usually is hot water, steam, smoke.

2.1.86 Waste heat

Discharge from industrial production with heated waste such as waste steam, high temperature waste water, high temperature smoke.

2.1.87 Design heat consumption of maximum hour

Maximum heat consumption per hour in the hot water supply system installation.

2.1.88 Reversed return hot water system

The length of supply and return pipeline is nearly equal in a hot water supply system.

2.1.89 Heat carrier circulation system

The heat medium circulating system between steam boiler and water heater or hot water boiler and hot water storage tank in the central hot water supply system.

2.1.90 Upfeed system

Water supply horizontal pipe is installed at the upper part of distribution pipe system, water flows downward through vertical pipe.

2.1.91 Downfeed system

Water supply horizontal pipe is installed at the lower part of distribution pipe system, water flows upward through vertical pipe.

2.1.92 Return pipe

Pipe section passing circulation flow only in the hot water circulation system.

2.1.93 Fine drinking water

Raw water confirms to drink standard quality through thorough purification can drink directly.

2.2 Symbols

2.2.1 Flow rate, flow velocity

q_g ——Water supply flow;

q_o ——Flow rate of water supply or drain of plumbing fixture;

q_p ——Drain flow;

q_r ——Rated hot water supply;

q_{rh} ——Designed hourly hot water supply;

q_h ——Hourly rated hot water supply of plumbing fixture;

q_x ——Circulation flow;

q_{max} ——Maximum flow;

q_{bc} ——Replenishing water;

q_y ——Designed rainwater flow;

q_j ——Designed rain fall intensity;

q_f ——Loss of water due to windage in cooling tower;

q_s ——Loss of water due leakage in cooling tower;

q_z ——Loss of water due evaporation in cooling tower;

q_b ——Pump outflow;

ν ——Average water flow velocity in the pipe.

2.2.2 Water pressure, loss of water head

R ——Hydraulic radius;

I ——Hydraulic gradient;
 P ——Pressure;
 i ——Loss of head of unit length pipeline;
 h_p ——Loss of head of circulation flow pass through distribution pipe net work;
 h_x ——Loss of head of circulation flow pass through return pipe net work;
 H_{xr} ——Natural pressure of the first circulation pipe;
 H_b ——Pump head.

2.2.3 Geometrical characteristics

F_{jr} ——Heating area;
 F_w ——Catchment area;
 h, H ——Height;
 V_q ——Total volume of air pressure water tank;
 V_{q1} ——Water volume of air pressure water tank;
 V_{q2} ——Regulated volume of air pressure water tank;
 V_r ——Volume of heat storage;
 V_p ——Effective volume of expansion water tank;
 V_e ——Volume of expansion water tank;
 V_s ——Water volume of hot water pipeline system;
 d_j ——Calculated pipe interior diameter.

2.2.4 Calculation coefficient

k, α ——Coefficient determination based on the use of building;
 b ——Percentage of plumbing fixture for water supply and drainage simultaneously and percentage of plumbing fixture work simultaneously;
 N_n ——Concentration multiple;
 n ——Coefficient of pipe roughness;
 K ——Coefficient of heat conduction;
 K_h ——Hourly variable coefficient;
 U ——Probability of simultaneous outflow of water supply of plumbing fixture;
 U_o ——Probability of average outflow of water supply of plumbing fixture during maximum water usage;
 α_a ——Factor of safety;
 α_b ——Working pressure ratio of air pressure water tank;
 α_c ——Coefficient correspond to U_o ;
 β ——Volume coefficient of air pressure water tank;
 Ψ ——Run off coefficient;
 M ——Discounted coefficient;

η ——Effective heat storage volume coefficient;
 ε ——Coefficient of heat transmission effectiveness due to scale deposit and uneven distribution of heat media;

C_r ——Heat loss coefficient of hot water supply system;

C_h ——Hazen-Williams roughness coefficient.

2.2.5 Heat, temperature, specific gravity and time

Q_g ——Designed hour heat supply;

Q_h ——Designed hour heat consumption;

Q_z ——Heat demand for heating hot water;

Q_s ——Heat loss of distribution pipeline;

t ——Rain fall duration;

t_1 ——Time of ground surface water catchment;

t_2 ——Time of storm water flow in pipe;

T ——Time of duration;

t_r ——Temperature of hot water;

t_l ——Temperature of cold water;

t_c ——Initial temperature of heated water;

t_z ——Final temperature of heated water;

Δt_j ——Calculated temperature difference;

t_{mc} ——Initial temperature of heat media;

t_{mz} ——Final temperature of heat media;

Δt ——Temperature of difference;

ρ_l ——Density of cold water;

ρ_r ——Density of hot water;

ρ_h ——Density of return hot water;

ρ_f ——Density of water in heating or storage unit before heating;

C ——Specific heat of water.

2.2.6 Other

N_g ——Total plumbing fixture water supply equivalent of pipe section;

N_p ——Total plumbing fixture water drainage equivalent of pipe section;

N_o ——Number of the same style plumbing fixture;

m ——Calculating unit of water consumption;

n_q ——Number of pump start.

3 Water Supply

3.1 Rated water consumption and water pressure

3.1.1 Water supply designed for water consumption of dwelling district should be determined according to following water consumption:

- 1** Residential domestic water consumption;
- 2** Public building water consumption;
- 3** Green belt water consumption;
- 4** Waterscape, amusement facilities water consumption;
- 5** Road, square water consumption;
- 6** Public facilities water consumption;
- 7** Unpredictable water consumption and pipe leakage water consumption;
- 8** Fire control water consumption.

Note: Fire control water consumption is calculated only for the check of pipes net, not belongs to normal water consumption.

3.1.2 Dwelling district's domestic water consumption should be determined by calculation according to its population and Table 3.1.9.

3.1.3 Dwelling districts public building water consumption should be determined by calculation according to its type, scope, adopt Table 3.1.10 listed rated water consumption.

3.1.4 Dwelling districts green sprinkling rated water consumption may be calculated according to sprinkling area $1.0 \sim 3.0 \text{ L}/(\text{m}^2 \cdot \text{d})$. Drought region may be accordingly increased; public swimming pool, aquatic recreation pool and waterscape consumption is determined according to regulation of Clause 3.9.17, 3.9.18, and 3.11.2.

3.1.5 Dwelling district road, square sprinkling rated water consumption may be calculated according to sprinkling area $2.0 \sim 3.0 \text{ L}/(\text{m}^2 \cdot \text{d})$.

3.1.6 Dwelling district's fire demand water and water pressure and duration of fire should be determined according to current "Code for design on building fire protection and prevention" and "Code for fire protection design of tall buildings".

3.1.7 The sum of unpredictable water consumption and pipe net leakage water consumption for dwelling district may be counted according to 10% ~ 15% of maximum daily water consumption.

3.1.8 The public service water consumption for dwelling district should be suggested by the management institute, when there is no important public service, water consumption is counted out.

3.1.9 For dwelling's maximum daily domestic rated water consumption and hourly variation factor, based upon class of residence, building standard level of sanitary installation and district

condition etc. factors, may be determined according to Table 3.1.9.

Table 3.1.9 Residence maximum daily domestic rated water consumption and hourly variation factor

Class of residence		Standard of plumbing installation	Rated water consumption (L/person·d)	Hourly variation factor K_h
Ordinary residence	I	Equipped with closet bowl, wash tub	85 ~ 150	3.0 ~ 2.5
	II	Equipped with closet bowl, wash basin, wash tub, washer, hot water heater and shower facility	130 ~ 300	2.8 ~ 2.3
	III	Equipped with closet bowl, wash basin, wash tub, washer, central hot water supply (or domestic hot water service unit) and shower facility	180 ~ 320	2.5 ~ 2.0
Villa		Equipped with closet bowl, wash basin, wash tub, washer, sprinkler valve, domestic hot water service unit and shower facility	200 ~ 350	2.3 ~ 1.8

Note: 1 When domestic rated water consumption is determined by local authority, it should comply with local regulation.

2 Green belt and car washing water consumption are included in the villa rated water consumption.

3.1.10 Dormitory, hotel etc. public buildings rated water consumption and hourly variation factor, based upon level of sanitary installation and district condition, may be determined according to Table 3.1.10.

3.1.11 Building inside, outside, the water for fire demands, duration of water supply, pressure etc. should comply with current relevant code of fire fighting.

3.1.12 Rated domestic water consumption for industrial enterprise building workers may be 30 ~ 50L/person·shift; workers of work ship rated domestic water consumption should be determined according to the nature of workshop, usually may be 30 ~ 50L/person·shift; duration is 8 hours, hourly variation factor is 1.5 ~ 2.5.

Rated shower water consumption for industrial enterprise building should comply with "Hygienic standards for the design of Industrial enterprises", classification is determined by hygienic characteristic of the workshop, usually may be 40 ~ 60L/person·time duration is 1 hour.

3.1.13 Rated washing water of vehicle should be determined according to those of usage, grade of road pavement, degree of condemnation and type of washing, may be determined according to Table 3.1.13.

3.1.14 Rated water supply flow, equivalent, diameter of branching pipe and lowest working pressure of plumbing fixture should be determined according to the Table 3.1.14.

Table 3.1.10 Dormitory, hotel and public buildings rated water consumption and hourly variation factor

Order	Type of building	Unit	Maximum day rated domestic water consumption (L)	Use duration (h)	Hourly variation factor K_h
1	Single man dormitory, student dormitory, guest house, training center, ordinary hotel With public wash room With public wash room, shower room With public wash room, shower room, laundry With private water closet, public laundry	Each person each day Each person each day Each person each day Each person each day	50 ~ 100 80 ~ 130 100 ~ 150 120 ~ 200	24	3.0 ~ 2.5
2	Hotel guest room Guest Staff	Each bed each day Each person each day	250 ~ 400 80 ~ 100	24	2.5 ~ 2.0
3	Hospital patient room With public wash room With public wash room, shower room With private water closet Doctor nurses Outpatient department, clinic Sanatorium	Each bed each day Each bed each day Each bed each day Each person each shift Each patient each time Each bed each day	100 ~ 200 150 ~ 250 250 ~ 400 150 ~ 250 10 ~ 15 200 ~ 300	24 24 24 8 8 ~ 12 24	2.5 ~ 2.0 2.5 ~ 2.0 2.5 ~ 2.0 2.0 ~ 1.5 1.5 ~ 1.2 2.0 ~ 1.5
4	House of oldage person Full case Day case	Each person each day Each person each day	100 ~ 150 50 ~ 80	24 10	2.5 ~ 2.0 2.0
5	Kindergarten, crèche With boarders Without boarders	Each infant each day Each infant each day	50 ~ 100 30 ~ 50	24 10	3.0 ~ 2.5 2.0
6	Public bath house Shower Bath tub, shower Sauna (shower, massage pool)	Each time each customer Each time each customer Each time each customer	100 120 ~ 150 150 ~ 200	12 12 12	2.0 ~ 1.5
7	Barber shop, beauty parlor	Each time each customer	40 ~ 100	12	2.0 ~ 1.5
8	Laundry	Each kg of dry cloth	40 ~ 80	8	1.5 ~ 1.2
9	Restaurant Chinese restaurant Snack counter, worker and student dinning hall Bar, coffee bar, tea house, KARAOK room	Each time each customer Each time each customer Each time each customer	40 ~ 60 20 ~ 25 5 ~ 15	10 ~ 12 12 ~ 16 8 ~ 18	1.5 ~ 1.2 1.5 ~ 1.2 1.5 ~ 1.2
10	Market Staff and customer	Each m^2 hall area each day	5 ~ 8	12	1.5 ~ 1.2
11	Office building	Each person each shift	30 ~ 50	8 ~ 10	1.5 ~ 1.2
12	Education, laboratory building Primary school middle school College	Each day each student Each day each student	20 ~ 40 40 ~ 50	8 ~ 9 8 ~ 9	1.5 ~ 1.2 1.5 ~ 1.2
13	Cinema, theater	Each spectator each performance	3 ~ 5	3	1.5 ~ 1.2
14	Health training center	Each time each person	30 ~ 50	8 ~ 12	1.5 ~ 1.2
15	Stadium Sportsman shower Spectator	Each time each person Each performance each person	30 ~ 40 3	— 4	3.0 ~ 2.0 1.2

Table 3.1.10(Continued)

Order	Type of building	Unit	Maximum day rated domestic water consumption (L)	Use duration (h)	Hourly variation factor K_h
16	Meeting hall	Each seat each time	6 ~ 8	4	1.5 ~ 1.2
17	Client of passenger station, exhibition center	Each time each person	3 ~ 6	8 ~ 16	1.5 ~ 1.2
18	Food market floor washing water and water for fresh	Each m^2 each day	10 ~ 20	8 ~ 10	2.5 ~ 2.0
19	Washing water for garage floor	Each m^2 each time	2 ~ 3	6 ~ 8	1.0

- Note: 1 Dining hall water consumption of house of old age person, kindergarten, crèche, are included in the rated water consumption, others are not included.
 2 Except noticed, domestic water of workers is not included. Rated domestic water of worker is 40 ~ 60L each shift each person.
 3 Water consumption of hospital building include those for medical treatment.
 4 Water consumption for air-condition are excluded and should be otherwise added.

Table 3.1.13 Rated flush water of vehicle (L/car·time)

Type of flushing	Soft tube flushing	High pressure nozzle flushing	Circulation water flushing	Rub down
Sedan	200 ~ 300	40 ~ 60	20 ~ 30	10 ~ 15
Bus, Truck	400 ~ 500	80 ~ 120	40 ~ 60	15 ~ 20

Table 3.1.14 Rated water supply flow, equivalent, diameter of branching pipe and lowest working pressure of plumbing fixture

Order	Water supply fittings	Rated flow (L/s)	Equivalent	Nominal diameter of branching pipe (mm)	Lowest working pressure (MPa)
1	Wash tub, sewage tub, toiled channel One value tap One value tap Mix tap	0.15 ~ 0.20 0.30 ~ 0.40 0.15 ~ 0.20(0.14)	0.75 ~ 1.00 1.50 ~ 2.00 0.75 ~ 1.00(0.70)	15 20 15	0.050
2	Wash basin One value tap Mix tap	0.15 0.15(0.10)	0.75 0.75 (0.50)	15 15	0.050
3	Wash hand basin Self open and close tap Mix value tap	0.10 0.15(0.10)	0.50 0.75 (0.50)	15 15	0.050
4	Bathtub One value tap Mix tap (including shower tap)	0.10 0.24(0.20)	1.00 1.20 (1.00)	15 15	0.050 0.050 ~ 0.070
5	Shower fitting Mix value valve	0.15(0.10)	0.75 (0.50)	15	0.050 ~ 0.100
6	Toilet bowl Flush tank floating valve Delay self closing flush valve	0.10 1.20	0.50 6.00	15 15	0.020 0.100 ~ 0.150
7	Urinal Manual or auto closing flush valve Self flush tank inlet valve	0.10 0.10	0.50 0.50	15 15	0.050 0.020
8	Urine channel perforated flush pipe (per meter long)	0.50	0.25	15 ~ 20	0.015

Table 3.1.14(Continued)

Order	Water supply fittings	Rated flow (L/s)	Equivalent	Nominal diameter of branching pipe (mm)	Lowest working pressure (MPa)
9	Bidet flush tap	0.10(0.07)	0.50(0.35)	15	0.050
10	Hospital sewage fixture	0.20	1.00	15	0.050
11	Laboratory chemical examination tap (goose neck type)				
	single connection	0.07	0.35	15	0.020
	Double connection	0.15	0.75	15	0.020
	Triple connection	0.20	1.00	15	0.020
12	Drinker jet	0.05	0.25	15	0.050
13	Sprinkle tap	0.40	2.00	20	0.050 ~ 0.100
		0.70	3.50	15	0.050 ~ 0.100
14	Indoor floor flush tap	0.20	1.00	15	0.050
15	House hold washing machine water supply tap	0.20	1.00	15	0.050

Note: 1 Figures in the bracket are used for the consumption of cold or hot water individually as those is with hot water supply.

- 2 Bathtub with shower fitting or mix tap with shower transfer valve, the rated flow and equivalent only count the tap, not including the shower. But the water pressure should be considered for shower fitting.
- 3 Household gas water heaters, the water pressure should meet the demand of product and the working pressure should be the worst distribution point of hot water supply.
- 4 The design of green belt automatic jet grouting should meet the demand of product.

3.2 Water quality and water quality pollution protection

3.2.1 The water quality of domestic water supply system should meet the requirement of current national standard "Sanitary standards for drinking water".

3.2.2 Water quality of non-drinking water supply system should meet the demand of current occupation standard "Water quality standard for domestic miscellaneous water".

3.2.3 It is strictly forbidden that the city water supply pipeline connects with supply pipeline of private water source.

3.2.4 Potable water should not be polluted by pipes occurrence of siphon backflow. The distribution-fitting outlet of potable water should comply with following regulation:

- 1 Outlet should not be submerged in any liquids or impurities;**
- 2 Minimum air gap between the outlet and the flood-level rim of water service fixture should not be less than 2.5 times of diameter of the outlet;**
- 3 As special appliance cannot reserve a minimum air gap, backflow preventer should be disposed or other effective separator must be taken.**

3.2.5 As water supply pipeline are directly connect with following service pipe, backflow preventer or other effective preventive back flow pollution measures should be disposed on this service pipe:

1 At the beginning of fire fighting service pipeline, as this pipeline is connected to individually;

Note: Outdoor water supply line connects to outdoor fire hydrant is not included.

2 At the suction pipe end, as the pump is directly sucks water from city water supply pipeline;

3 At the feeding (replenishing) pipe, as the air gap between feeding water or replenishing water pipe outlet of swimming pool, aquatic recreation pool, massage pool, amusement pool, circulation cooling water collecting pool and level of overflow is less than 2.5 times diameter of outlet;

4 At inlet pipe of boiler, hot water machine unit, water heater, pressure water tank etc. pressure vessels or closed vessels, those that are directly supplied from city water supply pipeline;

5 At the beginning starting point of flushing pipe and animal drinking water pipe of refuse treatment station, animal breeding ground (include exhibition zone of zoo);

6 At the beginning starting point of pipe as nozzle are underground or automatic lifter type for green belt automatic spray irrigation system;

7 At the inlet pipe (usually behind the water meter), from various pipe section of ring shaped city water supply pipe net system connecting to inlet pipe of dwelling area water supply, this water supply is a part of ring shaped pipe net.

3.2.6 It is forbidden that the potable water pipe is connected directly to the toilet bowl (channel).

3.2.7 The domestic drinking water pipe should avoid passing through the poisonous substance pollution region, if the condition do not permit to do so, the protection measure should be taken.

3.2.8 Domestic drinking water reservoir (tank) should be kept separate from non-drinking water reservoir (tank).

3.2.9 Within 10 m around buried potable water storage tank, there must be no septic tank, sewage treatment structure, seepage well, refuse dump, other contaminating source; Within 2 m around, there must be no sewage pipe and contaminated substance. If the condition do not permit to do so, the protection measure should be taken.

3.2.10 Potable water reservoir (tank) inside the building should be an independent structure, building structure elements can not be used for the wall, base slab, top cover of the reservoir (tank).

As potable water reservoir (tank) is parallel with non-drinking water reservoir, each tank should have its individual separated wall not in common with each other, between these separated walls, drainage should be installed.

3.2.11 Inside building domestic drinking water reservoir (tank) may be placed in its individual room, above this room, there should not be a closet, bath room, toilet, kitchen and sewage disposal room.

3.2.12 Structure and fitting for pipe of domestic drinking water reservoir (tank) should comply with following regulations:

1 Manhole, vent pipe, overflow pipe should set measures to prevent insects crawling in.

2 Inlet pipe into the reservoir (tank) should be above the overflow level, as the overflow level cannot be determined, the lowest point of inlet pipe will be higher than elevation of flood-level rim, this height equals diameter of inlet pipe, not less than 25mm, not greater than 150mm.

As inlet pipe end is a submerged flow, a hole should be drilled at top of the pipe, the hole diameter may be not less than 1/5 of pipe diameter. Suction air valve with the same holes diameter of pipe or other vacuum breaker of pipe may be installed on the hole.

Note: For low level water reservoir there is no siphon back flow, the inlet pipe is not regulated by this section, but the inlet water pipe still should be into reservoir above from the highest water level.

3 Short circuiting flow must not occur in inlet and outlet pipe, if necessary, flow guide apparatus should be installed.

4 Testing pressure water, pressure release discharge water of fire fighting pipe and other back flow water or overflow water could not flow in.

5 Outlet of emptying pipe and overflow pipe cannot directly connect with drainage structure or drain pipe, it should be indirectly connected.

6 Reservoir (tank) material, lining material and interior plaster must not affect water quality.

3.2.13 When the storage water in the potable water reservoir (tank) cannot regeneration within 48 h, water sterilization apparatus should be installed.

3.2.14 When nozzle or outlet short tube is connected from non-drinking water supply pipeline, preventive measures should be provided for drinking and using.

3.3 System selection

3.3.1 Outdoor water supply system of dwelling district, the water quantity should meet the demand of dwelling district's total water use.

Outdoors water supply system of dwelling district, should thoroughly utilize the city municipal water supply pipe net's water pressure and supply water directly. As the municipal water supply pipe net's pressure, quantity are insufficient, storage regulating tank and pressure rise facilities should be installed.

3.3.2 The pressure rise water supply system of dwelling district, the number of pressure rise station, scale and water pressure should be determined based upon the scale of district, height of building and distribution of building etc. factors.

3.3.3 Different usage or payment water supply pipe system inside the building water supplies system unit should be separate to individual pipe net behind the inlet pipe.

3.3.4 Maximum bearing working pressure of plumbing fixture fittings must not exceed 0.6MPa.

3.3.5 The vertical division block of high-rise building domestic water supply system should comply with following demands:

1 Static water pressure at the lowest distribution point of plumbing fixture in each sub zone should not exceed 0.45MPa, in special case should not exceed 0.55MPa.

2 Inlet pipe (or horizontal distribution pipe) water pressure is larger than 0.35MPa, pressure reducing or regulating facilities may be installed.

3 Water pressure of the worst water distribution point in each sub zone should meet the demand of water use pressure.

3.3.6 Domestic water supply system of building height not exceeds 100m, water supply may adopt vertical division block parallel water supply style or block pressure reduce style. Building height exceeds 100m may adopt vertically division block in series water supply style.

3.4 Pipe material, fittings and water meter

3.4.1 Pipe material and fittings selected by water supply system should comply with the demand of current product standard. Working pressure of pipe and fitting should not exceed nominally allowable working pressure in the product standard.

3.4.2 Pipe material selected by buried water supply pipe should be with anti-corrosion and bearing strength to stand corresponding ground surface loading, may select plastic water supply pipe, lined cast iron water supply pipe and perfect anti-corrosive treated steel pipe.

3.4.3 Indoor water supply pipe should select anti-corrosion and convenient to install and connect pipe material, may select plastic water supply pipe, plastic and metallic composite pipe, copper pipe, stainless steel pipe and perfect anti-corrosive treated steel pipe.

3.4.4 The material of all kinds of valve of water supply pipe, should be anti-corrosion and pressure resistant. Based upon the pipe diameter, pressure intensity and temperature requirement, valves may select copper, stainless steel, iron shell copper core and plastic etc.

3.4.5 Valves should be installed on the following water supply pipe section:

1 Inlet pipe section of dwelling district water supply pipe from municipal water supply pipeline.

2 Connecting point of dwelling district out door circular water supply line net, installation should base upon requirement of division. As the circular pipe net section is too long, division valve may be installed.

3 Starting point of branch pipe or building unite pipe connected from the dwelling district water supply main pipe.

4 Building unites pipe, before water meter and each branch of vertical pipe.

5 Starting point of distribution pipe connecting from indoor water supply line to the residential, public toilet; as the distribution branch pipe with 3 or more than 3 distribution points, valves should be installed.

6 Reservoir, water tank, pumping house, heating machine, pressure reducing valve, pre-

ventive apparatus of pipe backflow etc. valve should be installed, according to requirement.

3.4.6 The selection of valve used on water supply pipeline should be based upon following requirement:

- 1 For regulate water flow, water pressure, throttle valve, globe valve may be selected;
- 2 Pipe section with low resistance water flow (suction pipe of pump) gate valve may be selected;
- 3 Small installation space site, butterfly valve, ball valve may be selected;
- 4 Check valve may not be installed on two ways flows pipeline;
- 5 Larger diameter water pump, multiple functions valve may be selected on the outlet pipe.

3.4.7 Check valve should be installed on the following water supply pipe sections:

- 1 Inlet pipe;
- 2 Inlet pipe of closed water heating machine or water use facilities;
- 3 Outlet pipe of pump;
- 4 Outlet pipe section of water tank, water tower, elevated reservoir with use one pipe as inlet and outlet pipe.

Note: Check valve need not be installed on pipe section with back flow preventive facilities.

3.4.8 Type selection of check valve, should base on check valves location, water pressure in front of valve, tightness demand after closure and the magnitude of water hammer induced during the closing etc. factors and should comply with following demands:

- 1 In front of valve with low water pressure, swing check valve, ball check valve and shuttled check valve may be selected.
- 2 Section with high tightness demand after closure, spring check valve may be selected.
- 3 Section with the diminished closed water hammer, soundless quick closed check valve or slow closed check valve with damper may be selected.
- 4 Check valve blade or valve core should be automatically closed under gravity or spring function.

3.4.9 As the pressure of water supply pipe net is higher than the allowable maximum working pressure of distribution point, pressure reducing valve should be installed, the installation of pressure reducing valve should comply with following demands:

- 1 The ratio of pressure reducing for ratio pressure reducing valve should not be larger than 3:1, maximum pressure difference between in front of and behind the regulating valve shall not be larger than 0.4MPa, at the silent site shall not be larger than 0.3MPa.
- 2 The maximum pressure of distribution fixture behind the valve should be checked based upon the failure condition of the pressure reducing valve, this pressure should not exceed the product standard permitted testing pressure.

Note: 1 As the pressure reducing valves are working in series, calculated maximum pressure behind the valve may base on one of them is in failure condition.

2 Testing pressure of distribution fixtures usually take 1.5 times of its working pressure.

3 Water pressure in front of pressure reducing valve may be kept in stable, the pipe in front of this valve may not be concurrently used for distribution pipe.

4 As pressure is allowed to up and down behind the valve, ratio pressure reducing valve may be selected; as the pressure behind the valve needs in stable, static pressure reducing valve may be selected.

5 When pressure-reducing valve is installed in water supply line which is provided with high guarantee rate of water supply and may cause big economic loss due to water cut off, two parallel pressure-reducing valve may be installed, one for operation, one for spare, but by-pass pipe mustn't be installed.

3.4.10 Installation of pressure reducing valve should comply with following requirements:

1 The nominal diameter of pressure reducing valve should be the same with pipe diameter.

2 Valve and filter should be installed in front of pressure reducing valve; expansion joint of pipe should be installed behind pressure-reducing valve for reparation which needs to dismount valve body; during reparation water behind the valve may be flow back, other valve should be installed behind pressure-reducing valve.

3 Pressure gauges should be installed in front of and behind the pressure reducing valve point.

4 Ratio pressure reducing valve may be installed vertically, static pressure reducing valve may be installed horizontally.

5 Pressure reducing valve should be installed in such place where it is easy to drain off pipe filters water and to repair the pressure reducing valve, ground surface may provide drainage facilities.

3.4.11 When the water supply line occurs transient super pressure, and this transient super pressure may induce unsafety of use, pressure relief valve should be installed. The installation of pressure relief valve should comply with following demands:

1 Pressure relief valve used for release pipe net pressure, valve should be installed in front of this pressure relief valve.

2 The outlet of pressure relief valve should connect with drain pipe, drain water may flow into non-domestic water reservoir, as it drain directly, energy dissipation facility should be provided.

3.4.12 Valve should not be installed in front of safety valve, pressure release outlet should connect with drain pipe, let the pressure release water (steam) discharge into a safety place.

3.4.13 Air relief facility should be installed at the following pipe section of water supply pipe net:

1 Water supply pipe net with intermittent duty, at net end and the highest point, automatic air relief valve should be installed.

2 Water supply pipe net with rise and fall alignment behave air accumulation pipe section, automatic air relief valve or manual air relief valve may be installed at the summit point of this sec-

tion.

3 Pneumatic water supply installation, when automatic air supplement pneumatic tank is adopted, automatic air relief valve should be installed at the highest point of distribution pipe net.

3.4.14 The inlet pipe of regulation reservoir (tank) of water supply system, except the inflow may be cut-off automatically, automatic water level control valve should be installed, its diameter should be the same as the diameter of the inlet water pipe.

3.4.15 Pipe filter should be installed at the following section of water supply pipe:

1 In front of pressure reducing valve, automatic water level controlling valve, temperature regulating valve etc.

2 Inlet pipe of water heat machine, circulating cooling water inlet pipe of heat exchange device.

3 Suction pipe of water pump.

4 In front of general water meter, in front of residential family inlet water meter.

Note: Net of filter should be anti-corrosive; dimension of net hole should meet the demand of water use.

3.4.16 Water meter should be installed at the inlet of building, residential family inlet and public building with the requirement of calculating water consumption's pipe section.

3.4.17 Each family's water meter in a residence may be correspondingly concentrated for reading, may be put on out door; for indoor water meter, remote water meter, IC card water meter may be adopted.

3.4.18 Water meter diameter should comply with following requirements:

1 Diameter of water meter may be the same as water supply connecting pipe diameter;

2 Water meter of domestic water supply system with uniform water consumption should take the designed flow as the constant flow of meter;

3 Water meter of domestic water supply system with non-uniform water consumption should take the designed flow as the overload flow of meter;

4 During fire fighting, domestic water consumption and fire fighting water flow through water meter simultaneously, the sum of designed domestic water consumption flow and fire fighting flow should be check and should not exceed overload flow of water meter.

3.4.19 The water meter should be installed in such place when it is easy to inspect, cannot be influenced by frost, polluted and easily damaged.

Note: All water flow measurement instrument with various accumulating function of water flow may be the substitute of water meter.

3.4.20 Water hammer arrester should be installed according to pumping head, pipe direction, environmental noise etc. factors.

3.4.21 Site with strict sound-damping demand, elevated water supply pipe supporting frame should adopt vibration insulated structure; water hammer absorber may be installed at the distribution pipe starting end; connection of distribution branch with plumbing fixture fitting may adopt flexible hose.

3.5 Piping layout and pipe laying

3.5.1 Outdoor water supply pipes network of residential area, may form an annular net or connect to municipal water supply pipeline form an annular net.

There must be at least two connecting pipes between annular water supply pipe net and municipal water supply pipe, when one is interrupted, the other should be able to pass not less than 70% of flow.

3.5.2 Outdoor water supply pipeline of residential area, should be laid along the road parallel to the building, may be laid under the pedestrian-way, light carriage lane or grass cover; net clearance between building external wall and pipe wall may not be less than 1m, and cannot influence the building foundation.

The least net clearance between outdoor water supply pipe of residential area and other underground pipelines and arbor should comply with the regulation listed in appendix A of this code.

3.5.3 The buried depth of outdoor water supply pipe should determinate based on frozen depth of soil, traffic loading, material of pipe and pipe crossing etc. factors. Minimum earth cover on pipe top should not be less than 0.15m below the frozen-line. Under traffic lane earth cover on pipe top may not be less than 0.7m.

3.5.4 Valve of out door water supply pipe, valve chamber or valve sleeve may be provided.

3.5.5 In the outdoor pipe duct (trench), water supply pipe may be laid below the hot water pipe, heating pipe and above the refrigeration pipe and drainage pipe. The net clearance between water supply pipe and various other pipes, should meet the demand of installation work, and should not less than 0.3m.

When the indoor cold, hot water pipe laying horizontally in parallel, cold water pipe should be laid below he hot water pipe; when laying vertically in parallel, cold water pipe should be laid at the right hand side of hot water pipe.

Domestic water supply pipe may not be laid with the inflammable, combustible or other harmful liquid or gas pipe in the same duct (trench) together.

3.5.6 Indoor domestic water supply pipe may be laid as tree-shaped network, one way water supply.

3.5.7 Indoor water supply pipe should not pass through electrical distribution room, electrical lift control room, communication room, large and medium pattern computer room, center of computer net, VCD store room etc.. When this equipment comes in contact with water will be damaged and induced accident, and should avoid passing over these productive equipment.

Layout of indoor water supply pipe should not hinder productive work, traffic transportation and management of building.

3.5.8 Indoor water supply pipe should not be laid above the raw materials, products and equipment which will burn and explode when they come into contact with water.

3.5.9. Buried water supply pipe should avoid to be located in the place where may be damaged by

heavy weight. The pipe should not press through the foundation of productive equipment. In particular case when it must pass through, effective protective measures should be taken.

3.5.10 The water supply pipe should not be laid inside the flue pipe, ventilating duct, electric lift shaft and drainage channel. The water supply pipe must not pass through show window, wardrobe. Water supply pipe must not pass through toilet channel and urinal channel; the stack must be not less than 0.5m from the end of toilet, urinal channel.

3.5.11 The water supply pipe must not pass through expansion joint, settlement joint, deformation joint of building. When it must pass through, expansion joint and shear deformation measures should be taken.

3.5.12 Plastic water supply pipe may be concealed installation. Exposed installation vertical pipe should be located at the place where it is not easy to be struck, when it is not avoidable, protective measure outside the pipe should be taken.

3.5.13 Plastic water supply pipe must not be located at the upper edge of cooking stove, exposed water supply vertical pipe must not be less than 0.4m distant from the edge of cooking stove, 0.2m distant from edge of gas heater. When it cannot meet these demands, protective measures should be taken.

Plastic water supply pipe must not directly connect with water heater or boiler, not less than 0.4m metallic pipe section should be installed for transition.

3.5.14 Various kinds of valves for indoor water supply pipe may be installed in such place where it is easy to repair and convenient to operate.

3.5.15 The minimum horizontal clear distance between water supply pipe and drainage pipe in building, must not be less than 0.5m for parallel buried pipe, and 0.15m in crossing; the water supply pipe should be disposed over the drainage pipe.

3.5.16 The compensator facility for water supply pipe should based upon length of straight line, linear expansion of material, environmental temperature and variation of pipe water temperature, allowable deformation of pipe joint etc. factors determinate by calculation. The temperature deformation compensated by pipe net bend angle should be fully considered.

3.5.17 When the condensate of water supply pipe effects environment, damage ornaments, substances, anti-condensation coarse should be taken, its calculation and structure should comply with current "General principles for low-temperature insulation technique of equipments and pipes"

3.5.18 When water supply pipe is concealed installation, it should meet following demands:

- 1 Must not be laid in the building structure supporting member;
- 2 Main pipe and vertical pipe should be laid in the ceiling, pipe shaft; branch pipe may be laid in the plaster coarse of floor (ground) or pipe duct along the wall;
- 3 The outer diameter of branch pipe, which is laid in plaster coarse or pipe duct, should not be larger than 25mm;
- 4 Water supply pipe, which is laid in plaster coarse or pipe duct, may select plastic, metallic and plastic composite pipe or anti-corrosive metallic pipe;

5 Pipe which is laid in plaster coarse or pipe duct, when compression fitting or insert connection is adopted, manifold distribution water to plumbing fixture may be adopt, and no joint fitting on all the line, two end joints should be visible. Mark may be shown on the ground.

3.5.19 The dimension of shaft should be determined according to the amount of pipes to be laid, their diameter, arrangement and maintenance requirements together with the plan and structure of the shaft. When the necessity of inspection requires that workers get into the shaft, the width of its passage should not be less than 0.6m. In every layer of the shaft, it should be equipped with the outside opening inspection door.

Fire fighting limit and fire partition of shaft and inspection door should comply with the demand of fire fighting regulations.

3.5.20 Water supply pipe should not pass through air-defense underground shelter, when it must pass through, explosion proof valves should be installed according to the demand of air-defense work.

3.5.21 If the horizontal water supply pipe need to drain empty, the slope of 0.2% ~ 0.5% forward the sluice way should be set up.

3.5.22 Waterproof sleeve should be installed when water supply pipes pass through following structure portions or connections:

- 1 Pass through exterior wall of underground structure and basement;
- 2 Pass through roof;

Note: Sleeve is not needed when reliable waterproof measure is setting.

- 3 Pipe connections pass through R.C. reservoir (tank) walls or base slabs.

3.5.23 Exposed water supply vertical pipes pass through floor, water proof measures should be taken.

3.5.24 Outdoor exposed water supply pipe should keep away from being exposed to the ray of sun directly, plastic water supply pipe should have effective protective measures, at frozen region insulation layer should be taken, this layer should be fight and waterproof.

3.5.25 Water supply pipe is managed in such location as in freeze room, underground structure and shaft, duct etc., anti-freezing measure should be taken.

3.6 Design flow and hydraulic calculation of pipe

3.6.1 Residential district out door water supply pipe design flow should comply with following regulation:

1 When residential district population is below 3000 and the out door water supply pipe is a free-shaped network, the water supply of living area for its corresponding stadium, canteen, amusement, store and market, domestic water consumption design flow should be according to Clause 3.6.3, 3.6.4 and 3.6.5 of this code to calculate the connection joint flow and pipe section flow.

2 When residential district population exceeds 3000 and the out door water supply pipe is a

ring-shaped network and comply with Clause 3.5.1 of this code, the living area should be according to clause 3.1.9 to calculate maximum hour average second flow water consumption for the connection joint flow. In the living area, for its corresponding stadium, canteen, amusement, store and market, domestic water consumption design flow should be according to Clause 3.1.10 of this code to calculate the maximum water consumption hour at average second flow for the connection joint flow.

3 In the living area, the corresponding culture education, hospital sanatorium, district circle management facilities and make green waterscape consumption, road and square sprinkling water, public facilities water consumption etc. all are on average water consumption hour average second flow to calculate connection joint flow.

Note: 1 Unpredicted water consumption and pipe leakage water loss are not counted into net connection joint flow, only for the calculation of district pipe net connect with city pipe net inlet, those amount may take into consideration.

2 Corresponding public building not belong to the district should not be counted and added to the net.

3.6.2 Residential district out door water supply pipeline, despite of its scale and type of pipe net system, all should be based upon Clause 3.6.1 subclause 2 regulation to calculate connection joint flow, with the addition of once maximum fire fighting water consumption (should be with the deduction of fire fighting storage water and special fire fight pipe supply water), to check hydraulic calculation of the pipe flow, water pressure of out door fire hydrant pipe end should not be less than 0.1MPa count from the ground surface.

Out door water supply pipe without outdoor fire hydrant, the pipe diameter must be not less than 100mm.

3.6.3 Design flow of building water supply inlet pipe should comply with following demands:

1 When building domestic water consumption all are directly supplied by out door pipe net, building domestic water consumption design second flow should be taken.

2 When building domestic water consumption all are supplied by self-pressurized, design flow of inlet pipe should be the design replenishing flow of the water storage regulation reservoir. Design replenishing flow may not be exceed building maximum daily maximum hourly domestic water consumption and must not be less than building maximum daily average hourly domestic water consumption.

3 When building domestic water consumption are supplied by both out door pipe net and self-pressurized, the inlet pipe design flow should be the sum of calculated results according to subclause 1,2 of this Clause.

3.6.4 Design second flow of residential building domestic water supply should comply with following procedures and calculating methods:

1 Based upon residence plumbing fixture water supply equivalent, number of persons, rate of water consumption, number of hours and hour variation coefficient, according to Formula 3.6.4-1 to calculate the maximum water consumption of plumbing fixture water supply equivalent average

outflow probability:

$$U_o = \frac{q_o m K_h}{0.2 N_g T \cdot 3600} (\%) \quad (3.6.4-1)$$

Where U_o ——Domestic water supply pipe during maximum water consumption plumbing fixture water supply equivalent average outflow probability ($\%$);

q_o ——Maximum water consumption day water consumption rate, taken according to Table 3.1.9;

m ——Each family number of persons;

K_h ——Hour variation coefficient taken according to Table 3.1.9;

N_g ——Each family number of plumbing fixtures water supply equivalent;

T ——Water consumption hours (h);

0.2——Each plumbing fixture water supply equivalent rated flow (L/s).

2 Based upon calculated pipe sections plumbing fixture water supply equivalent total amount, according to Formula 3.6.4-2 to calculate this pipe section plumbing fixture water supply equivalent simultaneous outflow probability:

$$U = \frac{1 + \alpha_c (N_g - 1)^{0.49}}{\sqrt{N_g}} (\%) \quad (3.6.4-2)$$

Where U ——Calculated pipe section plumbing fixture water supply equivalent simultaneous outflow probability ($\%$);

α_c ——Coefficient corresponds to different U_o , find out from appendix C table C;

N_g ——Calculated pipe section plumbing fixture water supply equivalent total amount.

3 Based upon calculated pipe section plumbing fixture water supply equivalent simultaneous outflow probability, according to Formula 3.6.4-3 to calculate design second flow of this pipe section:

$$q_g = 0.2 \cdot U \cdot N_g (\text{L/s}) \quad (3.6.4-3)$$

Where q_g ——Design second flow of calculated pipe section (L/s).

Note: 1 After U_o is calculated, bases upon N_g of calculated pipe section, water supply pipe section design second flow can be find out from the table in Appendix D directly. Interpolation is available for use in this table.

2 When calculated pipe section's plumbing fixture water supply equivalent total amount exceeds the maximum value in table D, maximum water consumption hour average second flow should be taken as this flow, that is $q_g = 0.2 U_o N_g$.

4 Water supply main with two or more than two different maximum water consumption plumbing fixture water supply equivalent average outflow probability water supply branch, this pipe section's maximum hour plumbing fixture water supply equivalent average outflow probability may be calculated according to Formula 3.6.4-4:

$$\overline{U_o} = \frac{\sum U_{oi} N_{gi}}{\sum N_{gi}} \quad (3.6.4-4)$$

Where $\overline{U}_o$ ——Water supply main's plumbing fixture water supply equivalent average outflow probability;

U_{oi} ——Branch pipe's maximum water consumption hour plumbing fixture water supply equivalent average outflow probability;

N_{gi} ——Correspond branch pipe's plumbing fixture water supply equivalent total amount.

3.6.5 Domestic water supply design second flow of dormitory, hotel, guest house, hospital, sanatorium, kindergarten, old-age pension, office building, commercial establishment, passenger station, exhibition center, primary and middle school class room building, public toilet etc. should be calculated according to following formula:

$$q_g = 0.2\alpha \sqrt{N_g} \quad (3.6.5)$$

Where q_g ——Calculated pipe section's water supply design second flow (L/s);

N_g ——Calculated pipe section's water supply equivalent total amount of sanitary fixture;

α ——Coefficient determined according to the uses of building, should be taken according to Table 3.6.5.

Note: 1 If the calculated value is less than one of the maximum plumbing fixture water supply rated flow of this pipe sections', the design second flow should adopt this one of the maximum plumbing fixture water supply rated flow.

2 If the calculated value is greater than these pipe sections' calculated according to plumbing fixture water supply rated flow accumulated flow value, should adopt plumbing fixture water supply accumulated rated flow.

3 Water supply pipe section with toilet bowl self-closing flush valve (delayed-time action), the water supply equivalent of toilet bowl self-closing flush valve should take 0.5, calculated q_g adding 1.10L/s flow is the water supply design second flow of this pipe section.

4 α value of comprehensive building should be take the average value.

Table 3.6.5 Coefficient value (α value) based upon use of building

Type of Building	α value	Type of Building	α value
Kindergarten, crèche, house of old-age person	1.2	Hospital, sanatorium	2.0
Clinic, outpatient department	1.4	Dormitory, hotel, guest house	2.5
Office building, market	1.5	Passenger station, exhibition center, public toilet	3.0
School	1.8		

3.6.6 Industrial enterprise living area, public bath house, kitchen of public cater or restaurant, athlete rest room of stadium, cosmetic room of theater, physic and chemistry laboratory room etc., it's domestic water supply pipeline's design second flow should be calculated according to following formula:

$$q_g = \sum q_o N_o b \quad (3.6.6)$$

Where q_g ——Calculated pipe water supply design second flow (L/s);

q_o ——Same type one plumbing fixture water supply rated flow (L/s);

N_o ——Same type number of fixture;

b ——plumbing fixture simultaneously supply water percentage, should be adopted according to Table 3.6.6-1 ~ Table 3.6.6-3.

Note: 1 If calculated value is less than one of the maximums plumbing fixture water supply rated flow of these pipe sections, should adopt one of the maximum sanitary fixture water supplies rated flow as the design second flow.

2 Toilet bowl self-closing flush valve should be singly calculated when singly calculated valve is less than 1.2L/s, take 1.2L/s, larger than 1.2L/s, take the calculated value.

Table 3.6.6-1 Simultaneously water supply percentage of plumbing fixtures in industrial enterprise living area, public bath house, cosmetic room of theater, athlete rest room of stadium etc.

Name of plumbing fixture	Simultaneous water supply percentage (%)			
	Industrial enterprise living area	Public bath house	Cosmetic room of theater	Athlete rest room of stadium
Wash tub (basin)	33	15	15	15
Hand wash tub	50	50	50	50
Wash tub, channel tap	60 ~ 100	60 ~ 100	50	80
Bath tub	—	50	—	—
Shower without partition	100	100	—	100
Shower with partition	80	60 ~ 80	60 ~ 80	60 ~ 100
Closet bowl flush tank	30	20	20	20
Closet bowl self-closing flush valve	2	2	2	2
Urinal self-closing flush valve	10	10	10	10
Urinal (channel) self flush tank	100	100	100	100
Bidet	33	—	—	—
Drink jet	30 ~ 60	30	30	30
Canteen wash basin	—	50	—	50

Note: Health center sanitary room may take the simultaneous water supply percentage of athlete rest room of stadium in this table.

Table 3.6.6-2 Simultaneous water supply percentage of kitchen fixture at worker and student dining hall, restaurant.

Name of kitchen fixture	Simultaneous water supply percentage (%)	Name of kitchen fixture	Simultaneous water supply percentage (%)
Sewage tub (basin)	50	Utensil wash machine	90
Wash tub (basin)	70	Boiling water heater	50
Cooker	60	Steam generator	100
Food wash machine	40	Kitchen stove tap	30

Note: Utensil tap of workers or students will be 100% simultaneous water supply, but not add to kitchen consumption.

Table 3.6.6-3 Simultaneously water supply percentage of laboratory test tap

Name of test tap	Simultaneous water supply percentage (%)	
	Scientific research laboratory	Laboratory for production
Single connection laboratory test tap	20	30
Double or triple connection laboratory test tap	30	50

3.6.7 Building domestic water consumption maximum hour water consumption, should be determined by calculation according to Table 3.1.9 and 3.1.10 of this code.

3.6.8 Nominal diameter of inlet pipe of residential house may be not less Table 20mm.

3.6.9 Water flow velocity of domestic water supply pipeline may be taken according to Table 3.6.9.

Table 3.6.9 Water flow velocity of domestic water supply pipeline

Nominal diameter (mm)	15 ~ 20	25 ~ 40	50 ~ 70	≥ 80
Water flow velocity (m/s)	≤ 1.0	≤ 1.2	≤ 1.5	≤ 1.8

3.6.10 Water head loss along water supply pipeline may be calculated according to following formula:

$$i = 105 C_h^{-1.85} d_j^{-4.87} q_g^{1.85} \quad (3.6.10)$$

Where i ——Water head loss per unit length of pipeline (kPa/m);

d_j ——Pipe calculated internal diameter of pipe (m);

q_g ——Water supply design flow (m³/s);

C_h ——Coefficient of Hazen - Williams.

Various kind of plastic pipe, plastic lining pipe $C_h = 140$;

Copper pipe, stainless steel pipe $C_h = 130$;

Cement, resin lined cast iron pipe $C_h = 130$;

Steel pipe, cast iron pipe $C_h = 100$.

3.6.11 The partial head loss of domestic water supply net work may be calculated according to the method of pipe connections, and calculated by pipe fitting equivalent length method. When pipe fitting equivalent length data is insufficient, it may be taken according to following pipefitting connection and head loss along pipe network percentage:

1 Pipe (accessory) fitting internal diameter is the same of pipe diameter, when tee branch is used, take 25% ~ 30%; when manifold is used, take 15% ~ 20% .

2 Pipe (accessory) fitting internal diameter is slightly greater than pipe diameter, when tee branch is used, take 50% ~ 60%; when manifold is used, take 30% ~ 35% .

3 Pipe (accessory) fitting internal diameter is slightly less than pipe diameter, pipe (accessory) fitting is spigot and socket connection, when tee branch is used, take 70% ~ 80%; when manifold is used, take 35% ~ 40% .

Note: Appendix B is the friction loss equivalent length table for valve and fitting with treaded.

3.6.12 The head loss of water meter should be calculated according to specification of select production. When the production is not determined before, may be taken according to following stimulation:

1 Water meter of family inlet pipe may take 0.01MPa;

2 Water meter of building or district inlet pipe during domestic water consumption, may take 0.03MPa; during the check of fire fighting, may take 0.05MPa.

3.6.13 Head loss of ratio pressure reducing valve, the dynamic water pressure behind the valve may take 80% ~ 90% of the static water pressure behind the valve.

3.6.14 Partial head loss of pipe filter may take 0.01MPa.

3.6.15 Partial head loss of backflow prevention device of pipeline, may take 0.025 ~ 0.04MPa.

3.7 Water tower, Water tank, Reservoir

3.7.1 Residential district adopt water tower for domestic water consumption regulating structure, should comply with following regulations:

1 The effective volume of water tower should be determined by calculation;

2 Water tower should be thermal insulation with antifreeze measure.

3.7.2 Reservoir of pressurization pump house of residential district should comply with following regulations:

1 Effective volume of the reservoir of residential district pressurization pump station, the domestic water consumption regulating quantity should be determined by calculation according to flow in quantity and supply out quantity's variation curve, when data is insufficient it may be determined based upon maximum day water consumption's 15% ~ 20%.

2 Reservoir may be separated into two parts with same volume.

3.7.3 Domestic water consumption low level reservoir (tank) in the building should comply with following regulations:

1 Effective volume of reservoir (tank) should be determined by calculation according to flow in quantity and supply out quantity's variation curve, when data is insufficient, it may be determined based upon maximum day water consumption's 20% ~ 25%.

2 The clear distance between reservoir (tank) external wall and the building structure wall, should meet the demand of construction or assembling, and may not be less than 0.7m with no pipeline inside; not less than 1.0m with pipeline inside, passage way between pipe external wall and building wall may not be less than 0.6m; reservoir top with manhole, clear space between top slab surface and building bottom surface slab may not be less than 0.8m.

3 Reservoir (tank) may not be adjacent to electric operating room and living room or below.

4 Pump suction pits of reservoir, its dimension and depth, should meet the demand of pump suction pipe installation.

3.7.4 Pressurized water supply system without regulation demand, may provide suction well, its effective volume should be not less than pump's 3min. design second flow. Other demands of suc-

tion well should meet the regulation of Clause 3.7.3 of this code.

3.7.5 Domestic water consumption high elevated water tank should comply with following regulations:

1 Water consumption regulating volume of high elevated water tank with directly draw in water from city water supply net work at night, may be determined based upon number of persons and the highest water consumption ratio of flow; with pumps lifting water draw in tank, may not be less than 50% of maximum hour water flow.

2 The clear distance between high elevated water tank wall and room wall, tank top slab and room top slab, should comply with the regulation of Clause 3.7.3 subclause 2 of this code, its clear distance between tank bottom and room base slab, should not be less than 0.8m, where there is pipe laid.

3 Elevation of water tank (from surface of bottom slab) should meet the demand water pressure of highest floor water consumption family, if can't, pipe pressurized pump may be installed at the inlet pipe to the family.

3.7.6 Building reservoir (tank) should be arranged in the room with good ventilation and anti-freezed.

3.7.7 Water tower, reservoir, water tank must be provided with inlet pipe, outlet pipe, overflow pipe, sluice pipe and water level indication device and should comply with following demands:

1 Reservoir (tank) setup and pipeline layout should comply with Clause 3.2.9, 3.2.10, 3.2.12 and 3.2.13 of this code, relevant regulations for the prevention of water condemnation.

2 Inlet, outlet pipe may set up separately.

3 When directly draw in water from city water supply pressure network, automatic water level controlling valve should be provided. The diameter of control valve is the same of inlet pipe, when float valve is adopted, they may not be less than two, and with the same elevation of inlet pipe.

4 When tank water draw in by pressurizing pump, automatic water level control valve should not be installed at the inlet pipe, tank water level automatically controlling pump start, stop device should be installed. When pump supplies water to several tanks, motor driven valve should be installed at the inlet pipe of tank, automatic control is conducted by water level monitor. The diameter of motor driven electric valve should be the same of inlet pipe.

5 Overflow pipe may be a horizontal flared opening water collector; vertical pipe section below the flared opening may not be less than 4 times of overflow pipe. Diameter of overflow pipe should be determined based upon to drain away the maximum draw in flow of water tower (reservoir, tank) and may be larger than one grader of inlet pipe diameter.

6 Diameter of drain pipe should be determined base upon time of empty out reservoir (tank) and the acceptability of drain water. When water of reservoir (tank) cannot be empty out by gravity flow, movable or fixed lifting device should be installed.

7 Water tower, reservoir should set up water level over flow alarm monitor, water tank may

set up water level over flow alarm monitor. Information should be transmitted to the control center.

3.7.8 For domestic water consumption pipeline midway transfer water tank, its transferred regulating volume may be taken as 5 ~ 10 min of transfer pump's flow.

3.8 Pressurizing equipment, pump house

3.8.1 Selection of domestic water supply system's pressurizing pump should comply with following general regulations:

1 Pump's $Q \sim H$ characteristic curve should be the curve as the flow increased the water head decreased gradually.

Note: For $Q \sim H$ characteristic curve exists ascending section pump should analyze, during its operation there is no instability occurrence, it may be selected.

2 Selection of pump should base upon hydraulic calculation of pipe net, the operation of pump should be in the high effective range.

3 Domestic water supply pressurizing pump set should provide stand-by pump, its capacity should not be less than the capacity of one maximum operating pump in the set. Pump's operation may be automatically transferred and substituted.

3.8.2 Pressurizing pump station of residential district, when there is no regulating facility in this water supply net, water supply may be operated by regulating velocity pump set or rated velocity pump set. The maximum output of the pump set should not be less than the water supply design flow of this district, and should be checked with fire fighting.

3.8.3 Building elevated water tank is adopted to regulate domestic water supply system, the maximum pump output should not be less than maximum hour water consumption flow.

3.8.4 Domestic water supply system adopts regulating velocity pump, the selection of pump should base upon design second flow, regulating velocity pump at rated velocity hour's working point, it should be the end of high effective range of pump.

3.8.5 Domestic water supply system adopts pneumatic water supply installations, should comply with following regulations:

1 The minimum working pressure in pneumatic tank, should meet the demand of water pressure of distribution point at the pipe net's most unfavorable position;

2 The maximum working pressure of air pressure in pneumatic tank, must not be let the pipe net maximum water pressure distribution point's water pressure greater than 0.55MPa;

3 Pump's (or pump set's) flow (average pressure of pneumatic tank, corresponded flow of pump head) should not less than 1.2 times of water supply system maximum hour water consumption flow;

4 Regulating volume of pneumatic tank may be calculated according to following formula:

$$V_{q2} = \frac{\alpha_a q_b}{4n_q} \quad (3.8.5-1)$$

Where V_{q2} —Regulating volume of pneumatic tank (m^3);

q_b ——Outflow (m^3/h) of pump (or pump set);

α_a ——Coefficient of safety may take 1.0 ~ 1.3;

n_q ——Pump's starting frequency in 1 hour, may take 6 ~ 8.

5 Total volume of pneumatic tank may be calculated according to following formula:

$$V_q = \frac{\beta \cdot V_{q1}}{1 - \alpha_b} \quad (3.8.5-2)$$

Where V_q ——Total volume of pneumatic tank (m^3);

V_{q1} ——Water volume (m^3) of pneumatic tank, should be equal or greater than regulating volume;

α_b ——Ratio of working pressure in pneumatic tank (calculate with absolute pressure) may take 0.65 ~ 0.85;

β ——Volume coefficient of pneumatic tank, for diaphragm pneumatic tank may take 1.05.

3.8.6 Pump may be self-priming, each pump may be equipped independently with its suction pipe to suck water from reservoir. Velocity of flow in the suction pipe may be taken 1.0 ~ 1.2m/s; suction pipe's end should be equipped with downward flaring inlet, this flaring inlet must be lower than lowest water level of reservoir, may not be less than 0.5m, if it is not satisfied, preventive air suck in device should be taken.

Clear distance between flaring inlet and bottom of reservoir should not be less than 0.8 times the diameter of inlet pipe, and be not less than 0.1m; clear distance between edge of flaring inlet and tank wall may not be less than 1.5 times the diameter of inlet pipe; clear distance between inlets may not be less than 3.5 times the diameter of inlet pipe (take the average of adjacent pipes diameter).

Note: When water level of reservoir can not meet the demand of self-priming water level, protective measure should be provided to prevent starting of pump.

3.8.7 When each pump individually sucks water from reservoir with difficulty, may adopt individually sucking water from suction main pipe with self-priming, the suction main pipe should comply with following regulations:

1 The suction main pipe stretch into reservoir may not be less than two, when one pipe can't work, the other should be able to pass total design flow. Each pipe should be equipped with valve.

Note: Reservoir is separated into two or more than two individual parts, each part has one conduit may be regarded as two or more pipes.

2 The suction main pipe should set up downward flared opening, this flared opening should meet the corresponding requirements of Clause 3.8.6 of this code, and the flared opening lower than lowest water level may be not less than 0.3m.

3 Flow velocity of suction main pipe should be less than 1.2m/s.

4 Connection of pump suction pipe and suction main pipe should be at the pipe's top point

or higher than pipe top.

3.8.8 Reservoir lowest water level limits the allowable installation elevation of self-feeding type pump, it should base upon local atmospheric pressure, saturated steam pressure of highest water temperature, pump's air corrode residual and head loss of suction pipeline, determined by calculation, and should be taken not less than 0.3m for safety residual.

3.8.9 Outlet pipe of each pump should install pressure meter, check valve and valve (when multiple function valve accords with the installed condition of outlet pipe, it may substitute check valve and gate valve), when necessary should install water hammer arrester. Self-priming suction pipe should install valve and may equip pipe filter.

3.8.10 Residential district independent pump house, may be near by large water consumption family, noise of pump set should comply with the demand of current national standard "Standard of environmental noise of urban area".

3.8.11 Pump set installed inside the civil building, it may be set beside or below the suction tank, the noise of operation should comply with "Code for sound insulation design of civil buildings" regulation.

3.8.12 Water supply pump house inside the building should take following vibration and noise control:

- 1 Should select low noise pump;
- 2 Vibration insulator should be installed on the inlet and outlet pipe;
- 3 Vibration insulator device should be installed at the foundation of pump set;
- 4 Measures against sound transmission should be taken on pipe support, hanger, wall and slab pipe casing;

- 5 If necessary, wall and ceiling of pump house should be sound insulation and absorption.

3.8.13 The pump house must provide with drainage system; well ventilated and no frost occurrence in it.

3.8.14 Arrangement of pump set should comply with Table 3.8.14 regulations.

Table 3.8.14 Clear distance between the overall measurement of pump set and wall and neighboring pump sets should comply with regulations

Rated capacity of motor (kW)	Minimum distance (m) between the overall measurement of pump set and wall	Minimum distance (m) between the overall measurement of neighboring pump sets
≤ 22	0.8	0.4
$> 25 \sim 55$	1.0	0.6
$\geq 55, \leq 160$	1.2	1.2

Note: 1 When pipeline is beside the pump, the overall measurement of pump includes this pipe.

2 Pump set is the combination of pump and motor or a metallic frame with several pumps set.

3.8.15 Foundation of pump should be higher than ground surface and convenient for pump installation, should not be less than 0.1m; the distance between the bottom of pipe and ground surface, duct bottom of pipeline inside the pump house, when pipe diameter $\leq 150\text{mm}$, should not be

less than 0.2m; when pipe diameter $\geq 200\text{mm}$, should not be less than 0.25m.

3.8.16 Site for pump repair may be reserved, its dimension may be according to exterior dimension of pump or motor, around passage way in width not less than 0.7m. In the pump house, hand crane may be provided.

3.9 Swimming pool and aquatic recreation pool

3.9.1 Pool water quality hygienic standard of the world class swimming race pool, should meet the demands of international swimming league (FINA) with regard to swimming pool water quality hygienic standard.

3.9.2 Pool water quality hygienic standard of national swimming race pool and guest house attached swimming pool may meet the demands of international swimming league (FINA) with regard to swimming pool water quality hygienic standards. Pool water quality of other swimming pool and aquatic recreation pool should meet domestic relevant hygienic standard.

3.9.3 The quality of primary filling and operational replenishing water of swimming pool and aquatic recreation pool should meet the demands of current "Sanitary standards for drinking water".

3.9.4 The quality of drinking, showering etc. domestic consumption water should meet the demand of current "Sanitary standards for drinking water".

3.9.5 The water of swimming pool and aquatic recreation pool may be reused cyclically. The turnover time of swimming pool and aquatic recreation pool should be determined base upon pool's type, usage, pool volume, water depth, number of person use it etc. factors, generally may be adopted according to Table 3.9.5.

Table 3.9.5 Pool water turnover of swimming pool and aquatic recreation pool

Number	Type of pool		Turnover time(h)
1	Race pool, training pool		4 ~ 6
2	Dive pool		8 ~ 10
3	Swimming pool of club, guest house		6 ~ 8
4	Public swimming pool		4 ~ 6
5	Children pool		2 ~ 4
6	Infant playing pool		1 ~ 2
7	Wave making pool		2
8	Massage pool	Public	0.3 ~ 0.5
		Private	0.5 ~ 1.0
9	Slide pool, explore pool		6
10	Family swimming pool		8 ~ 10

Note: Number of turnover time may be determined by ratio of time of use each day and circulation period.

3.9.6 Aquatic recreation pool recycle water system should base upon water quality, water tem-

perature, water pressure and function of usage etc. factors to design one or some individual circulation piping systems.

3.9.7 The circulation water should be filtered, chlorinated, disinfected, if necessary should also be heated.

3.9.8 Hair interceptor should be equipped at the suction pipe of circulating water pump for pre-purification of circulation water.

3.9.9 Circulation water pump of slide track lubricating water system of aquatic recreation pool, stand-by pump must be provided.

3.9.10 Circulation water filtration treatment may adopt pressure filter, pressure filter should meet following demands:

1 Filter rate of filter should be determined by pool type and filter media. Filter rate of low rate filter may not be faster than 10 m/h, medium rate filter may be 10 ~ 25m/h, multiple layer filter media may be 20 ~ 30 m/h.

2 The number of filters and the surface area of one individual filter should be determined by technical and economical comparison according to the scale of circulation flow and its maintenance condition and operating condition, in general the number of filters should not be less than two.

3 Filter may be back washed with water, wash water pipe must not be connected with municipal water supply pipe net directly.

3.9.11 Circulation water during purification should be added by following dosage:

1 Before filtration adds coagulant;

2 Based upon kinds of disinfectant pH value regulation agent should be added before disinfecting;

3 Algaecide may be added based upon quality of pool water quality and temperature condition;

4 Based upon pool water pH value, total alkalinity, calcium hardness, total dissolved solid etc. water quality parameters, to add water quality balancing agent dose (water quality balance should ensure pool water quality meet the demand of hygienic standard).

3.9.12 Water of swimming pool and aquatic recreation pool must proceed disinfection bactericidal treatment.

3.9.13 Selection of disinfectant should meet following demands:

1 Strong bactericidal disinfecting ability and sustained bactericidal function;

2 Make no water and environmental pollution, no change of pool water quality;

3 No stimulation to human body or with a little stimulation;

4 No corrosion to building structure, equipment and pipeline or with slight corrosive action;

5 Low cost, locally available materials.

3.9.14 When liquid chlorine bottle is used for disinfections, chlorine should be proceeded with negative pressure automatic dosage, chlorine directly dosed into swimming pool water is prohibited. Chlorine room should be disinfected, fire proof and with explosion preventive

device and comply with relevant current code regulations.

3.9.15 Pool water designed temperature of swimming pool and aquatic recreation pool should be determined base upon type of pool in Table 3.9.15

Table 3.9.15 Pool water designed temperature of swimming pool and aquatic recreation pool

Number	Type of pool		Pool water designed temperature(℃)
1	Indoor	Race pool	25 ~ 27
2		Training pool, dive pool	26 ~ 28
3		Club, guest house swimming pool	26 ~ 28
4		Public swimming pool	26 ~ 28
5		Children, infant playing pool	28 ~ 30
6		Slide pool	26 ~ 29
7		Massage pool	Not higher than 40
8	Outdoor	With heating equipment	26 ~ 28
9		Without heating equipment	22 ~ 23

3.9.16 Heat amount demand for heating swimming pool water and aquatic recreation pool water should be determined by calculation and may adopt indirect heating pattern.

3.9.17 Time of primary water filling of swimming pool and aquatic recreation pool should be determined base upon the operating condition and city water supply condition, may be less than 24h, at most not exceed 48h.

3.9.18 Replenishing water of swimming pool and aquatic recreation pool may be determined according to Table 3.9.18. Large size swimming pool and aquatic recreation pool should adopt balancing reservoir or replenishing water tank to replenish water indirectly, family swimming pool etc. small size swimming pool may replenish water directly, replenish water pipe should be equipped with backflow pollution preventive device.

Table 3.9.18 Replenish water of swimming pool and aquatic recreation pool

Number	Type of pool		Percentage (%) of daily replenish water of pool water volume
1	Race pool, training pool, dive pool	Indoor	3 ~ 5
		Outdoor	5 ~ 10
2	Public swimming pool, aquatic recreation pool	Indoor	5 ~ 10
		Outdoor	10 ~ 15
3	Children pool, infant playing pool	Indoor	Not less than 15
		Outdoor	Not less than 20
4	Massage pool	Private	8 ~ 10
		Public	10 ~ 15
5	Family swimming pool	Indoor	3
		Outdoor	5

Note: Minimum replenishes water of swimming pool and aquatic recreation pool should be ensured to renew pool water once per month.

3.9.19 Equilibrium reservoir may be provided to balancing water level of swimming pool and aquatic recreation pool with steady flow type, mix flow type. Equilibrium reservoir should be provided to balancing water quantity of swimming pool and aquatic recreation pool with reverse flow type circulation water supply type.

3.9.20 Number of inlet and return outlet hole of swimming pool should meet the demand of circulation flow, the position should make a uniform flow without eddy and short circuit. Inlet flow rate velocity passing through the screen gap may not be higher than 1.0 m/s; back flow at screen gap should not be higher than 0.2 m/s. Inlet gap of screen must not be greater than 8 mm, pool bottom back flow screen gap for adult pool must not greater than 10mm, for children pool must not greater than 8mm.

3.9.21 The sluice hole of swimming pool should be set up at the lowest part of pool bottom, number of sluice hole are determined by calculation according to empty it with 4h. Overflow channel along pool wall may be provided.

3.9.22 Foot submerged disinfected basin should be provided at the entrance passage of swimming pool and aquatic recreation pool.

3.9.23 Pipeline, equipment, vessels, accessories should be anti-corrosive material or with anti-corrosive resistance lining, it should comply with relevant hygienic standard and with no effect to the pool water quality.

3.9.24 Dive pool for match must equipped with wave making equipment.

3.9.25 Dive pool water surface should be uniform, wave height may be 25 ~ 40 mm. Air blowing type may be adopted.

3.9.26 Water depth for infant playing pool may be 0.3 ~ 0.4 m, for adult playing pool may be 1.0m.

3.9.27 Water depth for children pool must not be greater than 0.6m, when one pool for different ages, rail separators should be provided.

3.10 Cooling tower and circulation cooling water

3.10.1 Design circulation cooling water system should comply with following demands:

- 1 Cooling water circulation system may be atmospheric cooling type;
- 2 Equipment for water temperature, quality, operation etc., with great difference, circulation cooling water system may be separately provided;
- 3 Water quality demand of atmospheric cooling system should meet the demand of cooling equipment's water quality;
- 4 Equipment and pipeline design should make the circulation systems residual pressure fully utilized.

3.10.2 In cooling tower design and calculation, the selection of dry bulb and wet bulb temperature should be identical with the dry bulb and wet bulb temperature of air condition system design and should adopt unassured 50h for average year of dry bulb and wet bulb temperature.

3.10.3 Selection of cooling tower location should be determined base upon following factors:

- 1 Air circulation should be normal, less effect by moist heated air back flow, and should be located at the building's minimum frequency wind ascending side.
- 2 Cooling tower should not be located at heating source, waste gas and smoke gas blow off

outlet, may not be located in a narrow belt between high buildings.

3 The distance between cooling tower and adjacent building should meet the demand of ventilation and noise, water atmosphere effect on buildings.

3.10.4 Selection cooling tower product should comply with following demands:

1 Selection must be based upon heat characteristic curve, which is prepared by producer. Design circulation water may not exceed the rated water of cooling tower, when circulation water can not reach 80% of rated water, water distribution system of cooling tower should be checked.

2 Cooling tower should be high cooling efficiency, save energy, low noise, light weight, small bulk, long life, simple installation, less water atmosphere.

3 Material should be non-combustible and should meet fire-proof demand.

4 Number of cooling tower may be coordinate with number of equipment of cooling water consumption, controlling operation.

5 Shape of tower should be determined according to building's demand, area and setup situation.

6 When the location of cooling tower can't meet Clause 3.10.3 demand, corresponding technical procedures and check of heat function should be proceeded.

3.10.5 Arrangement of cooling tower should comply with following demands:

1 Cooling towers may be arranged in a row. When arranged in double or more rows, the distance between rows should ensure the ventilation for simultaneous operation.

2 One side wind inlet face cooling tower may face to prevailing summer wind direction, double side wind inlet face cooling tower may parallel to prevailing summer wind direction.

3 The distance between cooling tower wind inlet face and the building may be 2 times the height of wind inlet opening. Around cooling tower, passage should be provided for pipeline installation, inspect, repair and ventilation demand. Clear width of passage may not be less than 1.0m.

3.10.6 Cooling tower should be set on specified foundation, can't directly set on floor or roof.

3.10.7 Environment need low noise level, following measures may be taken:

1 Location of cooling tower set up far from noise sensitive districts.

2 Low noise type cooling tower or super-low noise type cooling tower may be adopted.

3 Vibration isolative devices are installed on the inlet pipe, outlet pipe, replenish pipe of cooling tower.

4 Vibration insulating component is installed at the foundation of cooling tower.

5 Buildings are provided with acoustic absorbing barrier.

3.10.8 Number of circulating water pump may coordinate into condensers, and stand-by pump may be provided.

Output of circulating pump should be determined according to circulating water quantity, its water head should be determined according to the demand of circulating water pressure of equipment and pipe net, bearing capacity of pump should be checked.

3.10.9 Flow rate of cooling tower circulation pipe, may take following values:

1 When circulation main pipe diameter is less than or equals to 250mm, flow rate is 1.5 ~ 2.0m/s; when pipe diameter is greater than 250 mm, less than 500mm, flow rate is 2.0 ~ 2.5m/s; when pipe diameter is greater than or equals to 500mm, flow rate is 2.5 ~ 3.0m/s.

2 When circulation water pump sucks water from cooling tower collecting basin, flow rate of suction pipe may be 1.0 ~ 1.2 m/s; when circulation water pump sucks water directly from circulating pipe, suction pipe diameter smaller or equals 250mm, flow rate may be 1.0 ~ 1.5 m/s. When suction pipe diameter greater than 250mm, flow rate may take 1.5 ~ 2.0 m/s. Flow rate of pump outlet pipe may take the lower limit of main pipe flow rate.

3.10.10 Design of collection basin of cooling tower should comply with following demands:

1 Volume of collecting basin should be determined based upon the sum of following two factors:

- 1) Distribution water apparatus and filler of shower water quantity may be determined based upon 1.2% ~ 1.5% of circulation water quantity.
- 2) Least submerged depth of pump suction pipe end should be determined based upon flow rate of suction pipe. When flow rate is less than 0.6m/s, least submerged depth should not less than 0.3m; when flow rate is equals to 1.2m/s, least submerged depth should not less than 0.6m.

2 Selection cooling tower product, should comply with subclause 1 of this clause regulation, check the volume of collection basin, if it can't meet the demand, depth of the basin should be increased or set up other collection basin.

3 Many cooling towers connect in parallel without collecting basin, connection pipe should be installed between towers, each connecting pipe may be enlarged one grade than the diameter of main return pipe; the connection of connection pipe and outlet pipe of each towers should be top connected with pipe top at the same level. Air suction preventive device at outlet of tower should be installed.

4 Replenish water pipe, sluice pipe, sewer and overflow pipe should be installed at each cooling tower (set). Float valve or replenish water tank may be taken for water replenishment.

Several cooling tower possess one public collection basin, one set of replenish water pipe, sluice pipe, sewer and overflow pipe may be provided.

3.10.11 Replenish water of cooling tower may be calculated according to following formula:

$$q_{bc} = q_z + q_p + q_f = q_z N_n / (N_n - 1) \quad (3.10.11)$$

Where q_{bc} ——Replenish water quantity (m^3/h);

q_z ——Evaporation water loss(m^3/h);

q_p ——Blowdown water loss(m^3/h);

q_f ——Wind blow water loss(m^3/h);

N_n ——Concentration multiple, designed concentration multiple may not be less than 3.0.

Note: Replenish water for building air condition, freezing apparatus, usually may be determined according to 1% ~ 2% of circulating cooling water.

3.10.12 Building air condition system's circulation cooling water quality stability treatment should optimize the treatment method and equipment. When cooling circulation water quantity is more than $1000 \text{ m}^3/\text{h}$, water quality stability treatment, bactericidal, algacide and by pass treatment devices may be provided.

3.10.13 By pass treatment water quantity may be calculated respectively based upon removal of suspended matters or soluble solid. When suspended matters is removed by filtration, the filter water may be 1% ~ 5% of cooling circulation water.

3.11 Waterscape

3.11.1 Water quality of waterscape should comply with current "Water quality standard for scenery and recreation area" regulation. Circulation water should be treated with filtration when water quality of fountain nozzle requires.

3.11.2 Water provided for fountain should be used cyclically. The replenishing water of circulation system should be determined according to the loss amount of evaporation, wind effect, leakage, sewage drainage; for indoor it may be taken as 1% ~ 3% of circulating flow, for outdoor it may be taken as 3% ~ 10% of circulation flow.

3.11.3 Waterscape engineering should be according to nozzle's shape arranged in group. Each group nozzle of fountain should provide flow regulation device.

3.11.4 Pipeline of waterscape engineering should provide distribution pipe according to its different characteristic of nozzle, distribution pipe may be ring shaped, head loss may take $50 \sim 100 \text{ Pa/m}$. At the turn of pipe direction, smooth bending radius of pipe must be provided instead of bend, junction fittings; where pipe should change its diameter, the reducer should be used; before nozzle should be provided a straight pipe section in diameter of no less than 20 times of nozzle outlet diameter or provide a flow regulation device.

3.11.5 Circulating water pump of waterscape engineering may be provided with submerged pump, directly set at pool bottom.

The Circulating water pump of waterscape engineering may be set separately according to nozzle and fountain system in different characteristics. The flow and head of circulation water pump should be determined by means of calculation according to selected nozzle shape, height of water jet, diameter and number of nozzles and head loss of pipe system.

3.11.6 When potable water is used to replenish water of waterscape pool, preventive backflow pollution device should be installed.

3.11.7 Waterscape pool should be provided with replenish pipe, overflow pipe, sluice pipe. Around the pool may provide drainage facilities.

3.11.8 Operation mood of waterscape may be designed as manual control, program or sound control according to engineering demand; control panel should be set in control room according to the

demand of electrical engineering where should be dryness and Ventilation.

3.11.9 Waterfall, fountain, stream etc. waterscape engineering design should comply with following demands:

- 1 Design circulation flow should be 1.2 times of calculated flow.
- 2 Design of pool should comply with Clause 3.11.6 and 3.11.7 demand of this code.
- 3 Electric control may be set in nearby room.

3.11.10 Stainless steel or anti-corrosive pipe material may be provided for waterscape engineering.

4 Water Drainage

4.1 Selection of drainage system

4.1.1 Domestic drainage and rainwater split drainage system should be selected by newly built residential district.

4.1.2 Newly built building with following conditions may select domestic soil and domestic wastewater split drainage system:

- 1** Higher sanitary standard for building's nature of use.
- 2** Domestic soil needs to be treated by septic tank before discharge into municipal drainage pipe.
- 3** Domestic wastewater needs to be reuse.

4.1.3 Following building drainage should be individually discharged into treatment or reuse plant:

- 1** Public canteen kitchen-wash wastewater containing great quantity of grease;
- 2** Vehicle washing water;
- 3** Hospital sewage contains excessive disease germ, radioactive element beyond discharge standard.
- 4** Water temperature exceeds 40℃ boiler, water heater etc. heating facilities discharge water.
- 5** Domestic sewage for the source of reclaimed water.

4.1.4 Building rainwater pipe should be individually provided, at water short area impounding reservoir of rainwater may be provided.

4.2 Plumbing fixture and water lock

4.2.1 The number of plumbing fixture, which need to be installed must meet the requirement fixed in current relevant design standard, code or regulations.

4.2.2 Quality of material and technical requirements of plumbing fixture all should meet the requirements of current relevant concerning product fixed standard.

4.2.3 Selection of closet bowl should be determined based upon usage of user, location, building standard etc. factors. Water saving closet bowl should all be selected.

4.2.4 Urinal of public area should adopt time lag self-closing washout valve or auto washout device.

4.2.5 Wash hand basin of public area may adopt limit flow saving water installation.

4.2.6 Plumbing fixture without water lock connects with domestic sewer or other drain-pipe with harmful gas, water lock must be provided underneath its outlet, the depth of wa-

ter lock must not be less than 50mm.

4.2.7 Plumbing fixtures of clinic, dispensary, laboratory, test lab etc. set not in the same room must not install public water lock.

4.2.8 Installation height of plumbing fixture may be determined according to Table 4.2.8.

Table 4.2.8 Installation height of plumbing fixture

Order	Name of plumbing fixture	Height from brim of plumbing fixture to floor(mm)	
		Dwelling and public building	Kindergarten
1	Elevated sewage tub(basin)(up to upper brim)	800	800
2	Floor type sewage tub(basin)(up to upper brim)	500	500
3	Wash sink tub(basin)(up to upper brim)	800	800
4	Wash hand basin(up to upper brim)	800	500
5	Wash basin(up to upper brim)	800	500
6	Wash stand (up to upper brim)	800	500
7	Bath tub (up to upper brim)	480	—
	Massage bath tub (up to upper brim)	450	—
	Shower tub (up to upper brim)	100	—
8	Squatting pan, toilet bowl(from stop surface up to the bottom of elevated water tank)	1800	1800
9	Squatting pan (from stop surface up to the bottom of elevated water tank)	900	900
10	Closet bowl(up to bottom of low tank)		
	With visible discharge pipe	510	—
	With siphon jet	470	370
	With fall down	510	—
11	Closet bowl(up to upper brim)		
	With visible discharge pipe	400	—
	With siphon jet	380	—
	With fall down	380	—
12	Closet trough (from surface of step up to bottom of wash tank)		
	With visible discharge pipe	400	—
	With siphon jet	380	—
	With fall down	380	—
13	Vertical urinal (up to upper brim of reception basin)	100	—
14	Hang up type urinal (up to upper brim of reception basin)	600	450
15	Urinal through (up to step surface)	200	150
16	Basin for laboratory test (up to upper brim)	800	—
17	Bidet(up to upper brim)	360	—
18	Drinker(up to upper brim)	1000	—

4.3 Pipe location and pipelining

4.3.1 Residential district drainage pipe location should be determined base upon plan of district, elevation of topography, direction of drainage flow, according to short pipeline, shallow depth, and gravity flow principles.

4.3.2 Minimum buried depth of pipe of residential district should be determined base upon class of road traffic, bearing capacity of pipe material, bearing power of sub-soil etc. conditions, should comply with following requirements:

1 Pipeline under district main road and branch road, buried depth may be not less than 0.7m.

2 Domestic soil family connection pipe buried depth must be not higher than 0.15m to the frost line, and the earth cover depth may be not less than 0.3m.

4.3.3 Location of drainage pipe inside the building should meet following demands:

1 Distance between plumbing fixture and drainage pipe should be the shortest and least pipe turn.

2 Drainage vertical pipe may be set nearby the maximum discharged quantity drainage point.

3 Elevated pipeline must not be laid in the factory building with special demands for production process of hygienic request, and in the food and precious commodity store house, vent room, transformer house and elevator machine room.

4 The drainage pipe must not pass through settlement joint, expansion joint, deformation joint, smoke duct and vent duct.

5 The buried drainage pipe must not be arranged in such place where it is easy to be damaged by heavy load or pass through equipment foundation.

6 The drainage vertical pipe must not pass through bed room, sick room with higher silence request and may not be close to neighboring internal wall of bed room.

7 The drainage pipe may not pass through show window, ward robe.

8 Plastic vertical pipe should not be laid where it is easy to be damaged by mechanical stroke, when it is not avoidable, protective measure should be taken.

9 Plastic drainage pipe should be laid away from heating source, when it is not avoidable, heat insulation measure should be provided as the temperature of pipe surface exceeds 60℃. Net clearance between plastic pipe and edge of kitchen stove must not be less than 0.4m.

10 Condensation of moisture may occur on the surface of drainage pipe, anti-condensation measure should be taken base upon the nature of building and demand.

4.3.4 The drainage pipe must not pass through the upper part of domestic drinking water reservoir.

4.3.5 The drainage pipe must not be managed over the row material, products and equipment that will burn, explode when they fall into contact with water.

4.3.6 The drainage horizontal pipe must not be managed over the place in dinning hall, canteen's kitchen where the staple and non-staple food are to be prepared. If conditions do

not permit, correspondent protective measures must be taken.

4.3.7 The drainage pipe may be barred underground or managed visibly on the ground, under floor, if the architectural requires, may be concealed in pipe chase, pipe shaft, pipe cannal or furred ceiling, but it should be easy to install, inspect and repair. At the high temperature region, non-freezing in winter, it may be laid along the exterior wall of building.

4.3.8 Drainage pipe of plumbing fixture of domestic toilet may not pass through floor into other family.

4.3.9 Connection of indoor pipes should meet following regulations:

1 90° oblique T should be used for plumbing fixture drainage pipe vertically connect with horizontal drainage pipe directly.

2 45° oblique T or 45° oblique cross and leeward T or leeward cross is used for the connection of horizontal pipe and vertical pipe of drainage pipeline.

3 Connection between drainage vertical pipe and outlet pipe base, two 45° bend or 90° bend of curvature radius no less than four times of pipe diameter may be used.

4 The axis of drainage pipe should not be offset, when condition do not permit, an offset Z-shape pipe or two 45° bend may be used to connect.

5 Branch pipe connect with horizontal main, vertical pipe connects with horizontal main, may be at the level of horizontal main pipe top or within two side 45° scope to connect.

4.3.10 Expansion joint should be provided with plastic drainage pipe base upon expansion coefficient, expansion joint may be set at fitting collection spot. Drainage horizontal pipe should provide special expansion joint.

Note: buried indoor or outdoor pipe needs no expansion joint.

4.3.11 Plastic drainage pipes passed through building floor or fire preventive wall or pipe shaft wall, fire preventive devices are provided based upon nature of building, pipe diameter and installation condition and demand of fire prevention degree of perforated place.

4.3.12 Nearby drainage vertical pipe base connection of drainage branch pipes, should comply with following demands:

1 Drainage vertical pipe with merely out of roof vent pipe, the vertical distance between the connection of the lowest horizontal branch pipe and the base of drainage vertical pipe, must not be less than the figures listed in Table 4.3.12.

Table 4.3.12 Vertical distance between the lowest horizontal branch pipe and junction to vertical pipe base

Story number of connection of vertical pipe with plumbing fixtures	Vertical distance (m)
≤4	0.45
5 ~ 6	0.75
7 ~ 12	1.20
13 ~ 19	3.10
≥20	6.00

Note: When the base of vertical pipe enlarges one grade pipe diameter or horizontal main pipe diameter one grade greater than vertical pipe, the vertical distance listed in table can be diminished one level.

2 When the branch drainage pipe is connected with outlet pipe or horizontal drainage main, the horizontal distance between junction and base of vertical pipe may not be less than 3.0m and must not be less than 1.5m.

3 Horizontal branch pipe connects with horizontal main pipe in the pipe section turn to vertical, the distance between connection point and turning point should not be less than 0.6m.

4 The junction of drainage vertical pipe base and drainage branch pipe can't meet the demands fixed in present Clause subclause 1,2, drainage branch pipe should individually discharge to out door manhole or effective preventive back pressure device is provided.

4.3.13 Drainage pipe of following structures and facilities must not be directly with sewage waste pipe system, indirect drainage system should be adopted:

- 1 Sluice pipe and overflow pipe of domestic drinking water storage tank (reservoir).
- 2 Drainage of boiler, hot-water heater.
- 3 Drainage of hospital bactericidal disinfection equipment.
- 4 Drainage of cool condensed water of evaporation cooler, air-condition equipment.
- 5 Drainage of ground surface of cold storage of food or beverage and drainage of melted frost water pan of cold air machine.

4.3.14 Equipment indirect drainage may discharge into nearby wash basin, drainer. When it is impossible, drain ditch, drain funnel or vessels may be provided. Minimum air gap of indirect drainage hole may be determined according to Table 4.3.14.

Table 4.3.14 Indirect drainage hole Minimum air gap

Diameter of indirect drainage pipe(mm)	Minimum air gap in drainage hole(mm)
≤25	50
32 ~ 50	100
> 50	150

Note: The minimum air gap of indirect drainage hole of water storage tank for preparation of beverage must be not less than 150mm.

4.3.15 Funnel or vessel of indirect drainage must not be sprinkling, overflow and should be managed at the place where it is easy to inspect, clean up.

4.3.16 Domestic wastewater under following conditions may be discharged into drain ditch with cover:

- 1 Waste water contains large amount of suspended matters or sediments and need constantly washout;
- 2 A large number of equipment drainage branches, difficult for pipe junction;
- 3 Equipment drainage point position is not fixed;
- 4 Ground surface needs constantly washing.

4.3.17 Wastewater contains fiber or big matters, grid mesh or screen should be provided at the junction of drainage pipe.

4.3.18 Connection of outdoor drainage pipe should meet following demands:

1 Connection between drainage pipe and drainage pipe, manhole connection should be used.

2 Outdoor drainage may connect with pipe top in same level, except flow with waterfall.

3 The elevation of drainage pipe top must not be lower than the elevation of outdoor joining family pipe top.

4 Flow oblique angle at junction point must not be greater than 90° . When flow fall exceeds 0.3m, angle is not limited.

4.3.19 Indoor drain ditch and outdoor drainage junction, water lock device should be provided.

4.3.20 Drainage pipe passes through basement wall or underground structure wall, waterproof device should be provided.

4.3.21 The settlement of building may cause reverse slope of drainage pipe, preventive measures should be taken.

4.3.22 Sleeve used for drainage pipe passing through building floors and the vertical pipe bottom don't fasten, pipe support or fixed measure should be provided at vertical pipe bottom. Pipe support or fixed measure should be also provided at basement vertical pipe and turning point of drainage pipe.

4.4 Calculation of drainage pipe

4.4.1 Rated outflow of domestic drainage system of residential district is the 85% ~ 95% of corresponded rated water consumption of domestic water supply system.

The hourly variation coefficient of domestic drainage system of residential district is the same of corresponding domestic water supply system, it should be determined according to Clause 3.1.2 and 3.1.3 of present code.

4.4.2 Rated flow of domestic sewage of public building and hourly variation coefficient is the same of rated domestic water supply water consumption of public building and hourly variation coefficient, it should be determined according to Clause 3.1.10 of present code.

4.4.3 Design flow of domestic sewage of residential district should be determined base upon the sum of residential domestic sewage maximum hourly flow and public building domestic sewage maximum hourly flow.

4.4.4 Plumbing fixture outflow, equivalent and drainage pipe diameter should be determined base upon Table 4.4.4

Table 4.4.4 Plumbing fixture outflow, equivalent and drainage pipe diameter

Order	Name of plumbing fixture	Outflow(L/s)	Equivalent	Drainage pipe diameter(mm)
1	Wash sink, sewage tub(basin)	0.33	1.0	50
2	Dinning hall, kitchen wash tub(basin)			
	One compartment wash tub(basin)	0.67	2.00	50
	Double compartment wash tub(basin)	1.00	3.00	50
3	Washstand(each cock)	0.33	1.00	50 ~ 75
4	Wash hand tub	0.10	0.30	32 ~ 50

Table 4.4.4(Continued)

Order	Name of plumbing fixture	Outflow(L/s)	Equivalent	Drainage pipe diameter(mm)
5	Wash face tub	0.25	0.75	32 ~ 50
6	Bath tub	1.00	3.00	50
7	Shower fitting	0.15	0.45	50
8	Closet bowl			
	With elevated tank	1.50	4.50	100
	With low tank			
	With fall type	1.50	4.50	100
	With siphon, jet siphon type	2.00	6.00	100
	With self closing washing valve	1.50	4.50	100
9	Hospital use excrement apparatus	1.50	4.50	100
10	Urinal			
	With self closing washing valve	0.10	0.30	40 ~ 50
	With induction washing valve	0.10	0.30	40 ~ 50
11	Closet trough			
	≤ 4 squats	2.50	7.50	100
	> 4 squats	3.00	9.00	150
12	Urinal trough(each meter length)			
	self washing tank	0.17	0.50	—
13	Laboratory test basin(without cock)	0.20	0.60	40 ~ 50
14	Bidet	0.10	0.30	40 ~ 50
15	Drinker	0.05	0.15	25 ~ 50
16	House hold washing machine	0.50	1.50	50

Note: The diameter of drainage hose of house hold washing machine is 30 mm, with up drain the diameter of drainage hose of house hold washing machine is 19 mm.

4.4.5 Building domestic sewage design second flow of dwelling, dormitory, hotel, hospital, sanatorium, kindergarten, old age pension, office building, market, expo-center, school building etc. should be calculated according to the following formula:

$$q_p = 0.12\alpha \sqrt{N_p} + q_{\max} \quad (4.4.5)$$

Where q_p ——Calculated pipe section drainage design second flow (L/s);

N_p ——Calculated pipe section plumbing fixture drainage total equivalent;

α ——Coefficient, which base upon usage of building, is determined according to Table 4.4.5;

$q_{\max}$ ——Outflow of maximum plumbing fixture at calculated pipe section (L/s).

Table 4.4.5 Coefficient α determined by usage of building

Name of building	Water closet of dwelling, guest house, hospital, sanatorium, kindergarten, old age pension	Public toilet and closet of dormitory, hotel and the public buildings
α value	1.5	2.0 ~ 2.5

Note: When the calculated flow is greater than the accumulated outflow of plumbing fixture of the pipe section, the value of accumulated outflow of plumbing fixture of this pipe section must be taken when calculating.

4.4.6 The calculated domestic sewage design second flow of living area of industrial enterprises, public bath room, launch, kitchen of public dinning hall or canteen, laboratory, cinema, stadium, waiting room (air plane, ship) etc. should be calculated according to the following formula:

$$q_p = \sum q_o N_o b \quad (4.4.6)$$

Where q_p ——Calculated pipe section drainage design second flow (L/s);

q_o ——Outflow of similar sanitary fixture (L/s);

N_o ——Number of similar plumbing fixtures;

b ——Simultaneous drainage percentage of plumbing fixtures which must be taken according to Clause 3.6.6 of present code. The simultaneous drainage capacity of closet bowl of wash tank should be calculated according to 12%.

Note: When the calculated drainage flow is less than the drainage flow of one closet bowl, it should be calculated according to the drainage flow of one closet bowl.

4.4.7 The hydraulic calculation of horizontal drainage pipe should be according to the following formula:

$$v = \frac{1}{n} R^{2/3} I^{1/2} \quad (4.4.7)$$

Where v ——Velocity (m/s);

R ——Hydraulic radius;

I ——Hydraulic slope taking the slope of drainage pipe;

n ——Roughness coefficient, 0.013 for cast iron pipe, 0.013 ~ 0.014 for concrete, R. C. pipe, 0.012 for steel pipe, 0.009 for plastic pipe.

4.4.8 Minimum pipe diameter, minimum designed slope, and maximum designed degree of fullness of residential district out door domestic drainage pipe, may be determined according to Table 4.4.8.

Table 4.4.8 Residential district out door drainage pipe's minimum pipe diameter, minimum designed slope and maximum designed degree of fullness

Type of pipe	Pipe material	Minimum pipe diameter (mm)	Minimum designed slope	Maximum designed degree of fullness
House hold pipe	Buried plastic pipe	160	0.005	0.5
	Concrete pipe	150	0.007	
Branch pipe	Buried plastic pipe	160	0.005	0.55
	Concrete pipe	200	0.004	
Main pipe	Buried plastic pipe	200	0.004	
	Concrete pipe	300	0.003	

Note: House hold pipe diameter must not be less than building outlet pipe diameter.

4.4.9 Building domestic sewage cast iron pipeline's minimum slope and maximum designed degree of fullness may be determined according to Table 4.4.9.

Table 4.4.9 Building domestic sewage cast iron pipeline's minimum slope and maximum designed degree of fullness

Pipe diameter (mm)	General slope	Minimum slope	Maximum designed degree of fullness
50	0.035	0.025	0.5
75	0.025	0.015	
100	0.020	0.012	
125	0.015	0.010	
150	0.010	0.007	0.6
200	0.008	0.005	

4.4.10 Building plastic drainage horizontal branch pipe standard slope should be 0.026. Drainage horizontal main pipe may be based upon Table 4.4.10.

Table 4.4.10 Building drainage plastic horizontal main pipe minimum slope and maximum designed degree of fullness

Exterior diameter	Minimum slope	Maximum designed degree of fullness
110	0.004	0.5
125	0.0035	0.5
160	0.003	0.6
200	0.003	0.6

4.4.11 Domestic drainage vertical pipe's maximum outflow capacity should be determined according to Table 4.4.11-1 ~ Table 4.4.11-4 Diameter of vertical pipe must not be less than the connected horizontal branch pipe diameter.

Table 4.4.11-1 Cast iron drainage vertical pipe's maximum outflow capacity with vent pipe system

Drainage vertical pipe diameter (mm)	Outflow capacity (L/s)	
	With merely vent pipe through roof	With special vent pipe or main vent pipe
50	1.0	—
75	2.5	5
100	4.5	9
125	7.0	14
150	10.0	25

Table 4.4.11-2 Plastic drainage vertical pipe's maximum outflow capacity with vent pipe system

Drainage vertical pipe diameter (mm)	Outflow capacity (L/s)	
	With merely vent pipe through roof	With special vent pipe or main vent pipe
50	1.2	—
75	3.0	—
90	3.8	—
110	5.4	10.0
125	7.5	16.0
160	12.0	28.0

Note: Outflow capacity values listed in the table is based upon the base of pipe is enlarged one grade, if it is not enlarged, may be determined according to Table 4.4.11-1.

Table 4.4.11-3 Single vertical pipe drainage system's vertical pipe maximum outflow capacity

Drainage vertical pipe diameter (mm)	Outflow capacity (L/s)		
	With mixed apparatus	With plastic screw pipe	With spiral flow apparatus
75	—	3.0	—
100	6.0	6.0	7.0
125	9.0	—	10.0
150	13.0	13.0	15.0

Table 4.4.11-4 Domestic sewage vertical pipe's maximum outflow capacity without vent

Working height of vertical pipe (m)	Outflow capacity(L/s)				
	Vertical pipe diameter(mm)				
	50	75	100	125	150
≤2	1.00	1.70	3.80	5.00	7.00
3	0.64	1.35	2.40	3.40	5.00
4	0.50	0.92	1.76	2.70	3.50
5	0.40	0.70	1.36	1.90	2.80
6	0.40	0.50	1.00	1.50	2.20
7	0.40	0.50	0.76	1.20	2.00
≥8	0.40	0.50	0.64	1.00	1.40

Note: 1 Working height of drainage vertical pipe is the calculated distance between highest drainage horizontal branch pipe connected with vertical pipe and the centerline of outlet pipe.

2 Maximum outflow capacity of drainage vertical pipe may be determined by interpolation if the working height of vertical pipe is between two adjacent values.

3 Drainage pipe diameter is 100mm, its plastic pipe exterior diameter is 110mm, drainage pipe diameter is 150mm, its plastic pipe exterior diameter is 160mm.

4.4.12 Closet bowl drainage minimum pipe diameter must not be less than 100mm.

4.4.13 Minimum outflow pipe diameter from building must not be less than 50mm.

4.4.14 Multiple floor kitchen vertical pipe diameter must not be less than 75mm.

4.4.15 Drainage horizontal pipe of following places, pipe diameter should be determined according to following demands:

1 When drainage pipe of building base floor individually discharges, horizontal branch pipe diameter may be determined according to Table 4.4.11-4 working height ≤2m's value.

2 Public dining hall kitchen sewage, the pipe diameter is one grade greater than calculated diameter, the main must not be less than 100mm, the branch less than 75mm.

3 Hospital washing tub (basin) drainage pipe diameter must not be less than 75mm.

4 Urinal trough or connected with 3 and more than 3 urinals, sewage branch pipe diameter may not be less than 75mm.

5 Both pools outflow pipe diameter may be 100mm.

4.5 Pipe material, fittings and inspection well

4.5.1 Selection of drainage pipe material should comply with following demands:

1 Residential district drainage pipe, buried plastic pipe, spigot and socket concrete or R.C. pipe may be used. Buried drainage plastic pipe should be used, when domestic sewage treatment works set up in the residential district.

2 Building indoor drainage pipeline, building drainage plastic pipe and fitting or flexible joint drainage cast iron pipe and fitting should be used.

3 When drainage water temperature exceeds 40℃, metallic drainage pipe or heat resistant plastic drainage pipe should be used.

4.5.2 Outdoor drainage pipeline connection with following conditions shall adopt inspection well:

- 1 Pipe-turn and connect with branch pipes;
- 2 Change of pipe diameter, change of slope.

4.5.3 Out door drainage pipeline with pipe diameter less than 150mm, distance between two inspection well may not be greater than 20m. Pipe diameter equals 200mm, the distance may be greater than 30m.

4.5.4 Domestic drainage pipeline inspection well must not be set up inside the building, when it must be set up, sealed measures should be taken.

4.5.5 Inspection well diameter should be determined according to connecting pipe diameter, number and buried depth. Well diameter may be less than 0.7m, if well depth equals or less than 1.0m; well diameter may not be less than 0.7m, if well depth larger than 1.0m.

Note: Well depth is the depth from top face of cover to the well base, square well internal diameter means length of in side.

4.5.6 Flow channel should be provided in the inspection well of domestic drainage pipeline.

4.5.7 Water closet, wash room, sanitary room and other rooms need ground surface drainage, floor drain should be provided.

4.5.8 Floor drain should be set up near the sprinkling fixture's lowest floor surface.

4.5.9 Floor drain with water lock its depth must not be less than 50mm.

4.5.10 Selection of floor drain should comply with following demands:

- 1 Direct flow floor drain should be the priority selection.
- 2 Sealed floor drain should be taken at place of high sanitary standard or place of infrequent drain with floor drain.

3 Screen floor drain may be taken for the dinning hall, kitchen and public bathroom.

4.5.11 Outflow capacity of floor drain of shower room may be determined according to Table 4.5.11. When drain ditch is used, 8 showers may set up one 100 mm diameter floor drain.

Table 4.5.11 Floor basin pipe diameter of shower room

Number of showers	Floor drain pipe diameter (mm)	Number of showers	Floor drain pipe diameter (mm)
1 ~ 2	50	4 ~ 5	100
3	75		

4.5.12 On the domestic sewage pipeline, checkhole and cleanout should be arranged according to following regulations:

1 Cast iron drainage vertical pipe distance between checkhole may not be greater than 10m, plastic vertical pipe may be one checkhole for each six stories. Checkhole should be arranged in the lowest story of the building and highest story of more than two story and above with plumbing fixtures, when vertical pipe will be provided with offsets or Z-shape pipe, checkhole should be arranged at the upper part of the offsets and Z-shape pipe on that story.

2 Cleanout may be arranged on the cast iron drainage horizontal pipe linked with 2 and more than 2 closet bowls or 3 and more than 3 plumbing fixtures.

Cleanout may be arranged on the plastic drainage horizontal pipe linked with 4 and more than 4 closet bowls.

3 Checkhole or cleanout should be arranged at the drainage horizontal pipe with angle of turning flow greater than 45° .

Note: Checkhole can be substituted by turning angle accessory with cleanout.

4 Cleanout should be arranged when the maximum length between drainage vertical pipe base or outlet pipe's cleanout and outdoor inspection well's center is greater than the values listed in Table 4.5.12-1.

Table 4.5.12-1 Maximum length between drainage vertical pipe or outlet pipe's cleanout and outdoor inspection well's center

Pipe diameter (mm)	50	75	100	100 above
Max. Length (m)	10	12	15	20

5 The maximum distance between checkhole and cleanout on the straight pipe section of drainage horizontal pipe should comply with Table 4.5.12-2.

Table 4.5.12-2 Maximum distance between checkhole and cleanout on straight pipe section of drainage horizontal pipe

Pipe diameter (mm)	Type of clean equipment	Distance (m)	
		Domestic wastewater	Domestic soil
50 ~ 75	Checkhole	15	12
	Cleanout	10	8
100 ~ 150	Checkhole	20	15
	Cleanout	15	10
200	Checkhole	25	20

4.5.13 Cleanout is arranged on the drainage pipeline, it should comply with following regulations:

1 If cleanout is arranged on the drainage horizontal pipe, it may be arranged on floor or ground surface and have the same level with the ground. The distance between the cleanout disposed at the starting point of drainage horizontal pipe and the wall perpendicular to the horizontal pipe must be not less than 0.15m.

2 When a stopper will be disposed at the starting point of drainage pipe instead of cleanout, the distance between the stopper and wall should not be less than 0.4m.

Note: There elbow with cleanout may be used to instead of cleanout.

3 The dimension of cleanout arranged on the drainage pipe with diameter less than 100mm, should be the same as the diameter of pipe; the dimension of cleanout arranged on the drainage pipe with diameter equal to or more than 100mm should be 100mm.

4 Cast iron drainage pipe's cleanout, its material should be copper; hard density unplasticized polyvinyl chloride pipeline's cleanout, its material should be the same as pipe.

5 Connection pipe fitting of drainage horizontal pipe connects with cleanout should be the same

as the diameter of cleanout, 45° oblique T and 45° bend or two 45° bends composite fitting are used.

4.5.14 Checkhole of drainage pipe should comply with following regulations:

- 1 Checkhole on vertical pipe should be disposed 1.0m above the floor and should be 0.15m higher than the edge of plumbing fixture.
- 2 Checkhole of buried horizontal pipe, it should be disposed in a brick masonry well.
- 3 Checkhole of basement vertical pipe, it should be disposed above the base of pipe.
- 4 Cover of checkhole for vertical pipe should be faced to the direction easy to clean out; checkhole for horizontal pipe should be perpendicularly upward.

4.6 Vent pipe

4.6.1 Stack vent should be provided at top of domestic drainage vertical pipe.

Note: If there no condition to provided stack vent, non-vent stack may be provided.

4.6.2 Special vent pipe should be arranged under following conditions:

1 Domestic drainage vertical pipe undertakes designed flow of plumbing fixture drainage, when it exceeds Table 4.4.11-1, Table 4.4.11-2 listed merely stack vent of drainage vertical pipe's maximum drainage capacity, specific vent stack should be arranged.

2 Building requiring a higher standard with multiple stories dwelling and public buildings, 10 stories and more than 10 stories this domestic soil vertical pipe may arrange specific vent stack.

4.6.3 Ring vent pipe should be arranged on the following drainage pipe sections:

1 Connected with 4 and more than 4 plumbing fixtures and the horizontal branch pipe length are greater than 12 m's drainage horizontal branch pipe.

2 Connected with 6 and more than 6 closet bowls sewage horizontal branch pipe.

3 Provided with fixture vent.

4.6.4 The domestic drainage pipe inside the building requiring a higher level on hygienic and quietness should provide with fixture vent.

4.6.5 When inside building each floor drainage pipeline arranged loop vent, main vent stack or secondary vent stack should be disposed to connect loop vent of each floor.

4.6.6 When stack vent is not permitted or is impossible individually passing through roof, combined vent pipe may be used.

4.6.7 Vent vertical pipe must not accept fixture sewage, waste water and rainwater, must not connect with air conduit and smoke conduit.

4.6.8 Inside building absorb air valve must not be instead of vent pipe.

4.6.9 Connection between vent pipe and drainage pipe should comply with following regulations:

1 Fixture vent should be arranged on the outlet end of trap. Loop vent should be derived from the horizontal branch in extreme end between two plumbing fixtures and connect with the drainage branch pipe perpendicularly or at angle of 45° over its center line.

2 Fixture vent, loop vent should be linked with vent stack with upward slope not less than

0.01 over the edge of plumbing fixture not less than 0.15m.

3 The upward ends of specific vent stack and main vent stack should be linked with the part of aeration of vertical drainage pipe by mean of oblique tee on the upward edge of plumbing fixture at the highest level or over the checkhole. The downward ends should be linked with vertical drainage pipe by means of oblique tee under the lowest horizontal drainage branch.

4 Yoke vent pipe should be arranged on specific vent stack every two story, on main vent stack every 8 ~ 10 stories, and linked with vertical drainage pipe. The downward ends of yoke vent pipe should be linked with vertical drainage pipe by means of oblique tee under horizontal drainage branch pipe and its upward end should be linked with vertical vent pipe by means of oblique tee over the upper edge of plumbing fixture at a distance not less than 0.15m.

5 When H pipe fitting substitutes yoke vent pipe, the joining point of H pipe and vent pipe should be arranged on the upper edge of plumbing fixture not less than 0.15m.

6 When one piece vent pipe is used both for sewage vertical pipe and waste water vertical pipe, H pipe fitting may be joined every other floor with sewage vertical pipe and waste water vertical pipe. But under the lowest horizontal branch pipe connecting point, yoke vent pipe should be arranged.

4.6.10 Vent pipe arranged higher than roof should comply with following regulations:

1 The height of vent pipe above roof must not be less than 0.3m, and should be greater than the maximum thickness of snow, cap or hood should be installed at the top of vent pipe.

Note: If insulation layer was installed on roof, the height should calculate up from surface of insulation layer.

2 When there are windows or doors within 4m round the outlet of vent pipe, the vent pipe outlet should be 0.6m higher than top of window or led to the side without window or door.

3 On the flat roof where people usually stay, the outlet of vent pipe should not be less than 2m above the roof and lighting protection should be installed according to the lighting protection requirement.

4 The outlet of vent pipe should not be installed below the protrusive part of the building (e.g. eaves gutter, balcony and canopy etc.).

4.6.11 The diameter of vent pipe should be determined according to the drainage capacity and length of pipe, it should be less than 1/2 of drainage pipe diameter, and its minimum diameter may be determined base upon Table 4.6.11.

Table 4.6.11 Minimum diameter of vent pipe

Name of vent pipe	Drainage pipe diameter (mm)						
	32	40	50	75	100	125	150
Fixture vent	32	32	32	—	50	50	—
Loop vent	—	—	32	40	50	50	—
Vent stack	—	—	40	50	75	100	100

Note: Vent stack listed in the table indicate specific vent stack, main vent stack, secondary vent stack.

4.6.12 The diameter of vent stack with a length grater than 50m, its diameter should be the

same as drainage vertical pipe.

4.6.13 When vent stack length is less than 50m, and two and more than two drainage vertical pipes connect with one vent stack simultaneously, the diameter of vent stack should be determined taking the maximum one drainage vertical pipe base upon Table 4.6.11 and its diameter may not be less than any one drainage vertical pipe diameter.

4.6.14 Yoke vent pipe's diameter may not be less than vent stack diameter.

4.6.15 The diameter of stack vent may be equal to drainage vertical pipe diameter. In the coldest month the average temperature is lower than -13°C region, the diameter should be enlarged by one grade under 0.3m of floor or ceiling.

4.6.16 When two and more than two vent pipe of sewage vertical pipes link together, the sectional area of joint vent pipe should be 0.25 times of the sum of the sectional area of the greatest vent pipe and all sectional areas of the others.

4.6.17 Vent pipe may be plastic pipe, cast iron pipe with flexible joint to.

4.7 Sewage pump and catch pit

4.7.1 When residential district sewage pipe can't flow by gravity into municipal sewage pipeline, sewage pump house should be provided. Sewage pump house should be built an individual structure and should provide with sanitary protective insulation belt. The pump house design should comply with current "Code of design of outdoor wastewater engineering" regulation.

4.7.2 Domestic drainage of building basement, sewage catch pit and sewage pump draw discharge into outdoor inspection well. Basement floor drainage should provide with catch pit and hoisting device.

4.7.3 Sewage pump may provide individual drainage pipe, draining to outdoor, outlet horizontal pipe section should be sloped off toward the outlet. When two or two more pumps in common use one outlet pipe, gate valve and check valve should be installed on each pump outlet pipe, drainage of single pump should install check valve to prevent back flow.

4.7.4 In public building each domestic sewage catch pit arrange one stand-by unit of sewage pump.

Note: When two and two more pumps for ground surface drainage of basement, equipment machine room, garage, stand-by pump may be cancelled.

4.7.5 When catch pit can't provide accident discharge pipe, sewage pump should be supplied with continuous motive power.

Note: when sewage pump inlet pipe can be shut off, continuous motive power may not be supplied.

4.7.6 Starting and shutting off sewage pump should arrange automatic control assembly. Multiple pumps set may be mutually operated in parallel or in separated section.

4.7.7 Capacity, head of selection of sewage pump should comply with following requirements:

1 Capacity of residential district sewage pump should be determined base upon maximum hourly domestic sewage flow.

2 Capacity of building sewage pump should be determined base upon design second flow

of domestic sewage. When the discharge flow is regulated, it may be determined base upon maximum hourly flow of domestic sewage.

3 Pump head should be calculated base upon height of lift, head loss of pipeline system, and additional 2 ~ 3m outflow water head.

4.7.8 Design of catch pit should comply with following requirements:

1 The effective volume of catch pit may not be less than one maximum sewage pump's 5min outflow and the times of sewage pump starting must not be greater than 6 in an hour.

2 Catch pit should meet the volume requirement and also should meet the requirements of pump installation, water level controller and grid installation and inspection.

3 Catch pit's designed lowest water level should meet the demand of pump suction.

4 When catch pit is arranged in the basement, pit cover should be sealed and air ventilation system should be provided; when catch pit is arranged in the room with open air, ventilation by force draft should be provided.

5 The bottom of catch pit should be made a slope not less than 0.05 toward pump set. The depth and plan dimension of catch pit should be determined base upon pump type.

6 Self-washing pipe may be installed at the bottom of catch pit.

7 Water level indicator should be installed in catch pit, if necessary, water level alarm device should be provided and the signal will lead to management operation center.

4.7.9 Effective volume of domestic sewage regulation basin should not be greater than 6h average domestic sewage hourly flow.

4.7.10 Sewage pump, valve, pipe etc. should be anti-corrosive, big flow, not easy to clog.

4.8 Small domestic soil disposal

4.8.1 Grease sewage of public dinning hall and canteen should arranged to intercept the grease then after is permitted to discharge pipeline.

4.8.2 Design of grease interceptor should comply with following regulations:

1 Sewage flow should be calculated according to designed second flow;

2 Edible oil sewage flow velocity should not be greater than 0.005m/s;

3 Edible oil retention time may be 2 ~ 10min;

4 The volume for storing oil of grease interceptor with manual oil intercept must not be less than 25% of its effective volume;

5 Movable cover plate should be provided for grease interceptor. Inlet pipe should be possible to clean through;

6 The depth between outlet pipe base and bottom of grease interceptor may not be less than 0.6m.

4.8.3 Design of cooling tank should comply with following regulations:

1 Temperature higher than 40℃ drainage, their heat content first should be recovered and made use of, if it is impossible or is not rational, cooling tank should be provided before draining

into city drainage pipeline. Cooling tank should be arranged outdoor type.

2 Lowering temperature may use mix method in tank with higher temperature drainage water and cooling water. Cooling water should be low temperature waste water. Required cooling water quantity should be calculated according to heat balance method.

3 Volume of cooling tank should comply with following regulations:

- 1) When sewage drains intermittently, calculated effective volume should be based upon the sum of once maximum draining quantity and needed cooling water quantity.
- 2) When sewage drains continuously, thorough mixing of sewage water and cooling water should be ensured.

4 Pipeline of cooling tank should comply with following demands:

- 1) Inlet pipe end of high temperature pressure sewage may install sound damping device, when it evaporated twice, pipe end should be above the water level and should install preventive scalded device. Then there is no twice evaporation, pipe end may be submerged in water 200mm in depth and more.
- 2) Mixing of cooling water and high temperature water may adopt porous pipe sprinkling, when cooling water is potable water, back flow pollution preventive device should be taken.
- 3) Cooling tank siphon drainage pipe should be installed at the tank bottom.
- 4) Air vent should be installed, its outlet location should meet the safety, environment demands.

4.8.4 The distance between septic tank and intake structure of ground water must not be less than 30m.

4.8.5 Location of septic tank should meet following demands:

1 Septic tank may be located at the lower reach end of family pipe, may be convenient for being cleaning by motor car.

2 Distance between septic tank external wall and building external wall may not be less than 5m, building foundation is not affected.

Note: If septic tank confined to locate inside the building, air vent, odor control, and explosion proof measure should be taken.

4.8.6 Effective volume of septic tank should be the sum of sewage and sludge volume. The calculation parameter should comply with following regulations:

1 Quantity of sewage and sludge per person per day, should be determined according to Table 4.8.6-1.

Table 4.8.6-1 Quantity of sewage and quantity of sludge per capita per day

Type	Domestic soil and domestic wastewater discharge together	Domestic soil discharge independently
Quantity of sewage (L) per capita per day	Same as water consumption	20 ~ 30
Quantity of sludge (L) per capita per day	0.7	0.4

2 Detention period of sewage in the tank should be determined according to quantity of sewage, 12 ~ 24 h may be taken.

3 Period of sludge cleaning should be determined according to temperature of sewage and local weather condition, 3 ~ 12 months may be taken.

4 Water content of fresh sludge may be 95% , after fermentation concentration water content may be 90% .

5 Sludge after fermentation, its volume reduction coefficient may be 0.8.

6 Residual sludge volume after cleaning should be 20% of sludge volume.

7 The percentage of persons using septic tank to the total persons may be determined according to Table 4.8.6-2.

Table 4.8.6-2 Percentage of persons using septic tank

Name of building	Percentage (%)
Hospital, sanatorium, house of old age person, kindergarten (with broader)	100
Dwelling, dormitory, hotel	70
Office building, teaching building, laboratory building, living room in factory	40
Public dinning hall, canteen, cinema, stadium, market and similar public place (calculated by seats)	10

4.8.7 Structure of septic tank should meet following demands:

1 The proportion of septic tank length and depth, width should be determined by hydraulic calculation according to the sedimentation condition and quantity in stock of sewage suspended substances, but the depth (water level to bottom) must be less than 1.3m, width not less than 0.75m, length not less than 1.0m, the diameter of septic well must not be less than 1.0m.

2 For double compartment septic tank its first compartment volume may be the 75% of the total, for triple compartment septic tank the first compartment volume may be the 60% of the total, the 2nd and 3rd one each may be 20% of the total.

3 Septic tank compartment and compartment, tank and connection well there air vent hole should be provided.

4 Inlet, outlet of septic tank connection well should be arranged and connection with inlet pipe, outlet pipe.

5 Diversion panel should be arranged at the inlet pipe of septic tank, measures to intercept suspended sludge should be arranged at the outlet and between compartments.

6 Wall and bottom of septic tank should be leakage proof.

7 Manhole and cover should be arranged on the top slab of septic tank.

4.8.8 Hospital sewage must be disinfected. After disinfecting, the water quality should comply with current "Requirements for medical organization sewage discharge".

4.8.9 Hospital sewage treatment process should be determined according to character of sewage, discharge condition etc. factors, when it discharges into city drainage pipeline, primary treatment may

be taken, discharge into surface water, secondary treatment should be taken.

4.8.10 Sanitary protection isolated belt may be arranged between hospital treatment plant and sick-room, medical room, dwelling etc.

4.8.11 Sewage from infectious sickroom and normal sickroom may be separately treated when it is rational in technical and economical comparison.

4.8.12 Disinfected treated sewage must not be discharged into water body in upper reach of 1000m and in lower reach 100m from the centralized potable water intake point.

Disinfected treated sewage when discharge into recreation and sport activity use water body, fishery water body, should meet relevant standard demands.

4.8.13 When septic tank is taken as pretreatment before hospital sewage disinfected, the volume of septic tank should be calculated according to the retention time sewage in the tank not less than 36 h, sludge cleaning period may be 1a.

4.8.14 Chlorination of sewage may be adopted for disinfecting of hospital sewage (sodium hypochloride product, chlorine piece, chlorine lime, and chlorine lime extract or liquid chlorine). When transportation or supply is in difficulties, hypochloride manufactured in site, chemical made chlorine dioxide may be used for disinfection.

If there is special demand and the technological and economical comparison estimate that it is reasonable, ozone disinfection may be adopted.

4.8.15 Hospital building contains radioactive materials, heavy metal and other poisonous harmful substances sewage, if it is not comply with discharge standard, must be individually treated afterward may be discharge into hospital sewage treatment plant or city drainage pipeline.

4.8.16 Sludge of hospital sewage treatment plant may be centralized and treated by city environment department, if there is no treatment condition, high temperature fertilizing or lime digestion method may be adopted.

4.8.17 Process of domestic soil disposal facility should be determined according to sewage character, reuse or discharge demands.

4.8.18 Location of domestic soil disposal should meet following demands:

- 1 Near to municipal pipeline discharge point.
- 2 May be located at the least frequency windward side of residential district, isolated by green belt to the buildings.
- 3 May be located under ground of grassland, parking ground and vacancy area.
- 4 If it is located in the basement of the building, it should be specially separated.
- 5 Distance between disposal and water supply pump house and reservoir may not be less 10m in horizontal.

4.8.19 Domestic soil disposal is arranged in room or basement, good ventilation system should be taken when it is an open air type, hourly air exchange may not be less 15 times, when it is covered, hourly air exchange may not be less than 5 times.

4.8.20 Domestic soil disposal should provide odor control facility, its outlet should be arranged to make no trouble to human, animal and plants.

4.8.21 Mechanical operation noise of domestic sewage disposal must not exceed the demands of current national standard "Standard of environmental noise of urban area" and "Code for sound insulation design of civil buildings". Isolated room should be provided for higher operation noise machine inside the building.

4.9 Rainwater

4.9.1 Roof rainwater drainage system should drain roof rainwater to outdoor rainwater conduit or ground quickly, timely.

4.9.2 Design rainwater flow should be calculated according to following formula:

$$q_y = \frac{q_j \Psi F_w}{10000} \quad (4.9.2)$$

Where: q_y ——Design rainwater flow (L/s);
 q_j ——Design rainfall intensity (L/s·ha);
 Ψ ——Run off coefficient;
 F_w ——Catchment area (m²).

4.9.3 Design rainfall intensity should be determined according to local or adjacent region storm intensity formula calculation.

4.9.4 Design rainfall duration of building roof, building foundation, residential district rainwater pipeline may be determined according to following regulations:

- 1 Roof rainwater drainage pipeline design rainfall duration may be 5 min.
- 2 Residential district rainwater pipeline design rainfall duration should be calculated according to following formula:

$$t = t_1 + Mt_2 \quad (4.9.4)$$

Where: t ——Rainfall duration (min);
 t_1 ——Ground surface catchment time (min), depends upon distance, slope of topography and pavement, normally may take 5 ~ 10min;
 M ——Reduction coefficient. branch and family service pipe: $M = 1$; main: conduit, $M = 2$, ditch, $M = 1.2$;
 t_2 ——Time of rainwater flow in drainage pipe (min).

4.9.5 Drainage recurrence interval of roof rainwater drainage pipeline should be determined according to the importance degree of the building, quality of catchment area, topography feature, character of atmospheric phenomena etc, factors, design recurrence interval of various kinds of catchment area may not be less than value, listed in Table 4.9.5.

Table 4.9.5 Design recurrence interval of various kinds of catchment area

Name of catchment area		Design recurrence interval(a)
Outdoor ground	Residential district	1 ~ 3
	Station, wharf, airport base	2 ~ 5
Roof	Roof of ordinary building	2 ~ 5
	Roof of important public building	10

Note: Factory roof rainwater drainage design recurrence interval is determined by production process, degree of importance etc. factors

4.9.6 Rainwater run off coefficient of various roof surface, ground surface is adopted according to Table 4.9.6

Table 4.9.6 Run off coefficient

Kind of roof surface, ground surface	Ψ
Roof	0.90
Concrete and bituminous pavement	0.90
Stone block pavement	0.60
Graded macadam pavement	0.45
Dry brick and macadam pavement	0.40
No pavement ground surface	0.30
Park green land	0.15

Note: Comprehensive run off coefficient of various kinds catchment area should be weighted average calculated.

4.9.7 Rainwater catchment area should be calculated according to ground, roof horizontal projective area. Higher than roof side wall should add one half the maximum raining face normal projective area as the effective catchment area calculated. Window shaft, high-rise building exterior wall near by basement garage ramp access and high-rise building subsidiary house roof rainwater catchment area, should add one half of higher than roof side wall area.

4.9.8 Building roof rainwater drainage engineering should provide with overflow opening, overflow weir, overflow pipe system. Overflow drainage must not do harm to building facilities and pedestrian safety.

4.9.9 General building gravity storm roof rainwater drainage engineering and overflow facilities total discharge capacity should not be less than 10 years recurrence interval rainwater quantity. Important public building, high-rise building roof rainwater drainage engineering and overflow facilities total discharge capacity should not less than 50 years recurrence interval rainwater quantity.

4.9.10 Building roof rainwater pipeline design flow pattern may comply with following regulations:

- 1 Gutter exterior drainage may be gravity flow design.
- 2 Long roof gully exterior drainage may be pressure flow design.
- 3 High-rise building roof rainwater drainage may be gravity flow design.
- 4 Large scale roof rainwater drainage of industry factory building, warehouse, public building may be pressure flow design.

4.9.11 High-rise building subsidiary house roof rainwater should discharge individually.

4.9.12 Balcony drainage system should be provided individually. Balcony rainwater down pipe base should drain indirectly.

4.9.13 When roof rainwater pipe is pressure flow design, same system rain strainers may be arranged in same plan level.

4.9.14 Rain strainers should be arranged for roof drainage system. Corresponding rain strainer should be selected for different drainage flow pattern, drainage character of roof rainwater drainage system.

4.9.15 Rain strainer location should be determined according to roof catchment condition and building's structure loading, pipe system laying etc. factors.

4.9.16 Design drainage capacity of rain strainer should be determined according to various kinds rain strainer character and roof drainage circumstance etc. conditions.

4.9.17 Roof gully arrangement should be as line of demarcation of expansion joint, settlement joint, deformation joint.

4.9.18 Slope of roof gully may not be less than 0.003.

4.9.19 Inside residential district arrangement of gutter inlet should be based upon topography, building situation, along roadway, gutter inlet may be arranged at following points:

- 1 Road crossing and the lowest point of road surface.
- 2 Building entrance and road intersection.
- 3 Near building rainwater down pipe.
- 4 District vacancy, low point of green land.
- 5 Entrance of underground ramp (drain ditch with grid).

4.9.20 Hanged pipe of gravity flow roof rainwater drainage system shall not be full flow design, filling degree may not be greater than 0.8, pipe flow rate may not be less than 0.75 m/s.

4.9.21 Buried pipe of gravity flow rainwater drainage system may be full flow discharge design, pipe flow rate may not be less than 0.75 m/s.

4.9.22 Maximum design discharge flow of gravity flow roof rainwater drainage down pipe should be determined according to Table 4.9.22.

Table 4.9.22 Discharge flow of gravity flow roof rainwater drainage down pipe

Cast iron pipe		Plastic pipe		Steel pipe	
Nominal diameter (mm)	Maximum discharge flow (L/s)	Nominal exterior diameter × wall thickness	Maximum discharge flow (L/s)	Nominal exterior diameter × wall thickness	Maximum discharge flow (L/s)
75	5.46	75 × 2.3	5.71	108 × 4	11.77
100	11.77	90 × 3.2	9.22	133 × 4	21.34
		110 × 3.2	15.98		
125	21.34	125 × 3.2	22.92	159 × 4.5	34.69
		125 × 3.7	22.41	168 × 6	38.52
150	34.69	160 × 4.0	44.34	219 × 6	81.90
		160 × 4.7	43.34		
200	74.72	200 × 4.9	80.78	245 × 6	112.28
		200 × 5.9	78.53		
250	135.47	250 × 6.2	146.21	273 × 7	148.87
		250 × 7.3	142.63		
300	220.29	315 × 7.7	271.34	325 × 7	242.49
		315 × 9.2	264.15		

4.9.23 Residential district rainwater pipeline may be designed as full gravity flow, pipe flow rate may not be less than 0.75 m/s.

4.9.24 Pressure flow roof rainwater drainage pipeline should comply with following regulations:

1 Height difference between hanged pipe and rain strainer outlet should be greater than 1.0 m.

2 Design flow velocity of hanged pipe may not be less than 1 m/s, design flow velocity of vertical pipe may not be larger than 10m/s.

3 The sum of head loss of rainwater drainage pipe and discharge head loss must not be greater than geometrical height difference of rainwater pipe inlet, outlet.

4 Head loss of hanged pipe may not be greater than 80kPa.

5 Calculated head loss difference of various branch at the upper reach of pressure flow drainage pipe system each joints, should not be greater than 10kPa for pipe diameter equal DN 75; should not be greater than 5kPa for pipe diameter greater than DN 100.

6 Outlet of pressure flow drainage pipe system should be enlarged its diameter, the flow velocity may not be exceed 1.8m/s, when the outlet flow velocity exceeds 1.8m/s, energy absorber should be installed.

4.9.25 Minimum pipe diameter of various rainwater pipeline and its horizontal pipe minimum design slop may be determined according to Table 4.9.25.

Table 4.9.25 Rainwater pipeline minimum pipe diameter and its horizontal pipe minimum design slop

Kind of pipe	Minimum pipe diameter (mm)	Horizontal pipe minimum design slope	
		Cast iron pipe, steel pipe	Plastic pipe
Building exterior wall rainwater down pipe	75(75)	—	—
Rainwater drainage vertical pipe	100(110)	—	—
Gravity flow drainage hanged pipe, buried pipe	75(75)	0.01	0.005
Pressure flow roof drainage hanged pipe	50(50)	0.00	0.00
District around building rainwater unite pipe	200(225)	0.005	0.003
District road main pipe, brand pipe	300(315)	0.003	0.0015
13 # ditch end gutter inlet connecting pipe	200(225)	0.01	0.01

Note: Cast iron pipe diameters are nominal diameter, parenthesis values are plastic pipe exterior diameter.

4.9.26 Selection of rainwater drainage pipe material should comply with following regulations:

1 Multi-story building gravity flow drainage system may adopt building drainage plastic pipe, high-rise building may adopt pressurized plastic pipe, metallic pipe.

2 Pressure flow drainage system may adopt pressurized drainage cast iron pipe with smooth lining, pressurized plastic pipe and steel, plastic composite pipe etc, the working pressure of pipe material should be greater than the static water pressure due to building height. Pressure flow drainage plastic pipe, pipe material hoop deformation resistance external pressure should be greater than 0.15 MPa.

3 District rainwater drainage system, buried plastic pipe, concrete pipe or R.C. pipe, cast iron pipe etc. may be selected.

4.9.27 Each catchment area of building roof, rainwater down pipe may not be less than 2 pipes.

4.9.28 Gravity flow roof rainwater drainage system, hanged pipe diameter may not be less than rain strainer connecting pipe diameter, down pipe diameter may not be less than hanged pipe diameter.

4.9.29 Pressure flow roof rainwater drainage system, down pipe diameter should be determined by calculation, may be less than upper reach horizontal pipe diameter.

4.9.30 Roof rainwater drainage pipe's turning point may be joined along the line of flow.

4.9.31 Expansion and contraction device must be provided according to roof rainwater drainage pipe length, operation condition pipe material, etc.

4.9.32 Gravity flow rainwater drainage system hanged pipe length greater than 15m, checkhole should be arranged, its spacing may not be greater than 20m and should be located easy to maintenance.

4.9.33 Buried outlet pipe of roof rainwater drainage pipe system, down pipe base cleanout should be provided.

4.9.34 Rainwater checkhole maximum spacing may be determined according to Table 4.9.34.

Table 4.9.34 Maximum spacing of rainwater checkhole

Pipe diameter (mm)	Maximum spacing (m)	Pipe diameter (mm)	Maximum spacing (m)
150(160)	20	400(400)	40
200 ~ 300(200 ~ 315)	30	≥ 500(500)	50

Note: Values in parenthesis are plastic exterior pipe diameter.

4.9.35 In cold region, down pipe of rainwater should be arranged inside the building.

4.9.36 Rainwater tube should be fixed firmly on the building structure bearing wall.

5 Hot water and drinking water supply

5.1 Rated consumption, temperature and quality of hot water

5.1.1 Hot water rated consumption should be determined according to Table 5.1.1-1, based upon plumbing fixture completeness and local conditions.

Plumbing fixture one time and hourly hot water consumption and temperature should be determined according to Table 5.1.1-2.

Table 5.1.1-1 Hot water rated consumption

Order	Building name	Unit	Maximum daily rated consumption (L)	Time of use (h)
1	Residence With self-contained hot water supply and bath fixture	Each person each day	40 ~ 80	24
	With concentrated hot water supply and bath fixture	Each person each day	60 ~ 100	
2	Villa	Each person each day	70 ~ 110	24
3	Dormitory for singles students dormitory, guest house, training center, ordinary hotel	Each person each day	25 ~ 40	24 Or timed supply
	With public wash room	Each person each day	40 ~ 60	
	With public wash room, shower room	Each person each day	50 ~ 80	
	With public wash room, shower room, laundry	Each person each day	60 ~ 100	
4	Guest house	Each bed each day	120 ~ 160	24
	Guest Staff	Each person each day	40 ~ 50	
5	Hospital sick room	Each bed each day	60 ~ 100	24
	With public wash room	Each bed each day	70 ~ 130	8
	With public wash room, shower room	Each bed each day	110 ~ 200	24
	With private water closet	Each person each shift	70 ~ 130	24
	Hospital staff	Each patient each time	7 ~ 13	24
	Outpatient department, clinic Sanatorium, rest house dwelling department	Each bed each day	100 ~ 160	24
6	House of old age person	Each bed each day	50 ~ 70	24
7	Kindergarten, crèche	Each child each day	20 ~ 40	24
	With boarders Without boarders	Each child each day	10 ~ 15	10
8	Public bath house	Each guest each time	40 ~ 60	12
	Shower		60 ~ 80	
	Shower, bath tub Sauna (shower, massage pool)		70 ~ 100	

Table 5.1.1-1(Continued)

Order	Building name	Unit	Maximum daily rated consumption (L)	Time of use (h)
9	Barber shop, beauty parlor	Each guest each time	10 ~ 15	12
10	Laundry	Each kilogram dry cloth	15 ~ 30	8
11	Restaurant	Each guest each time	15 ~ 20	10 ~ 12
	Trade canteen		7 ~ 10	11
	Snack counter, workers and students dinning ball		3 ~ 8	18
	Bar, coffee bar, teahouse, karaoke room			
12	Office building	Each person each shift	5 ~ 10	8
13	Health training center	Each person each time	15 ~ 25	12
14	Stadium	Each person each time	25 ~ 35	4
	Sportsman shower			
15	Meeting hall	Each seat each time	2 ~ 3	4

Note: 1 Hot water temperature is 60°C.

2 Rated consumptions listed in this table all are included in Table 3.1.9, 3.1.10 of present code.

3 In this table, 60°C hot water temperature is the calculated temperature, water consumption temperature of plumbing fixtures are listed in Table 5.1.1-2.

Table 5.1.1-2 One time and hourly rated hot water consumption and temperature of plumbing fixtures

Order	Sanitary fixture	Consumption one time (L)	Consumption hourly (L)	Water temperature (°C)
1	Residence, hotel, villa, guest house			
	With shower fitting bath tub	150	300	40
	Without shower fitting bath tub	125	250	40
	With shower fitting	70 ~ 100	140 ~ 200	37 ~ 40
	With wash stand, wash tub tap	3	30	30
	With wash basin	—	180	50
2	Dormitory, guest room, training center shower fitting			
	With shower room	70 ~ 100	210 ~ 300	37 ~ 40
	Without shower room	—	450	37 ~ 40
	With wash tub tap	3 ~ 5	50 ~ 80	30
3	Public canteen			
	Wash tub	—	250	50
	Wash basin: for worker	3	60	30
	For customer	—	120	30
	Shower fitting	40	40	37 ~ 40
4	Kindergarten, crèche			
	Bath tub: for kindergarten	100	400	35
	for crèche	30	120	35
	shower fitting: for kindergarten	30	180	35
	for crèche	15	90	35
	Wash tub tap	15	25	30
	Wash tub	—	180	50

Table 5.1.1-2(Continued)

Order	Sanitary fixture	Consumption one time (L)	Consumption hourly (L)	Water temperature (°C)
5	Hospital, sanatorium, restroom			
	Wash hand basin	—	15 ~ 25	35
	Wash tub	—	300	50
	Bath tub	125 ~ 150	250 ~ 300	40
6	Public bath room			
	With bath tub	125	250	40
	With small shower room	100 ~ 150	200 ~ 300	37 ~ 40
	Without small shower room	—	450 ~ 540	37 ~ 40
	With wash basin	5	50 ~ 80	35
7	Office building wash hand basin	—	50 ~ 100	35
8	Barber shop, beauty parlor wash basin	—	35	35
9	Laboratory			
	Wash basin	—	60	50
	Wash hand basin	—	15 ~ 25	30
10	Theater			
	With shower fitting	60	200 ~ 400	37 ~ 40
	With wash basin for performer	5	80	35
11	Stadium shower fitting	30	300	35
12	Living room in factory			
	Shower fitting: general workshop	40	360 ~ 540	37 ~ 40
	Dirty workshop	60	180 ~ 480	40
	Wash basin or wash tub tap			
	General workshop	3	90 ~ 120	30
	Dirty workshop	5	100 ~ 150	35
13	Bidet	10 ~ 15	120 ~ 180	30

Note: The general workshops represent the workshops of third and forth grade hygienic characters stipulated in the current "Hygienic standards for the design of industrial enterprise", while dirty workshops represent the workshops of first and second grade hygienic characters in accordance with the stipulations of code above mentioned.

5.1.2 Domestic hot water quality, should meet the demands of current "Sanitary standards for drinking water".

5.1.3 Central hot water supply system's raw water treatment, based upon water quality, water quantity, water temperature, water heating facility structure, using demand etc. factors with technique and economic comparison, should be determined according to following conditions:

1 Laundry daily hot water consumption (60°C calculated) is greater than or equals to 10m³ and when raw water total hardness (CaCO₃ calculated) is more than 300mg/L, softening treatment should be adopted; when raw water total hardness is 150 ~ 300mg/L, softening treatment may be adopted.

2 Other domestic daily hot water consumption (60°C calculated) is greater than or equals to 10 m³, when raw water total hardness (60°C calculated) is more than 300 mg/L, water softening or stabilizing treatment may be adopted.

3 After softening treatment water quality total hardness may be laundry water 50 ~ 100 mg/L, other water: 75 ~ 150 mg/L.

4 Water stabilizing treatment should select suitable physical treatment or chemical stabilizer treatment, according to water hardness, flow velocity, temperature, time or effective length and working voltage.

5 When dissolved oxygen demand needs higher control in the system deoxidization device may be submitted.

5.1.4 Cold water calculated temperature should be determined based upon data of local coldest month average water temperature, when there are not data of water temperature, it may adopt figures in Table 5.1.4.

Table 5.1.4 Calculated temperature of cold water

District	Temperature of surface(℃)	Temperature of underground(℃)
Heilongjiang; Jilin, Inner Mongolia whole part; Liaoning large part; Hebei, Shanxi, Shaanxi northern part; Ningxia eastern part	4	6 ~ 10
Beijing, Tianjin, Shandong whole part; Hebei, Shanxi, Shaanxi large part; Hebei northern part; Gansu, Ningxia, Liaoning southern part; Qinghai eastern part; Jiangsu northern part	4	10 ~ 15
Shanghai, Zhejiang whole part; Jiangxi, Anhui, Jiangsu large part; Fujian northern part; Hunan, Hubei eastern part; Henan southern part	5	15 ~ 20
Guangdong, Taiwan whole part; Guangxi large part; Fujian, Yunnan southern part	10 ~ 15	20
Chongqing, Guizhou whole part; Sichuan, Yunnan large part; Hunan, Hubei western part; Shaanxi and Gansu Qinling southern part, Guangxi northern part	7	15 ~ 20

5.1.5 The highest temperature of water at the outlet of hot water boiler, hot water machine set or heater of direct hot water supply and the lowest temperature of water at distribution point may adopt the figures in Table 5.1.5.

Table 5.1.5 The highest temperature of water at the outlet of hot water boiler, hot water machine set or heater of direct hot water supply and the lowest temperature of water at distribution point

Treatment of water quality	The highest temperature of water at the outlet of hot water boiler, hot water machine set or heater (℃)	lowest temperature of water at distribution point (℃)
Unnecessary to submit a softening treatment or already submitted to softening treatment	75	50
Necessary to submit a softening treatment but having not submitted a softening treatment	60	50

Note: The lowest temperature at distribution point may be not lower than 40℃, when hot water supply system only supply shower and washing water not wash tub water.

5.2 Selection of hot water supply system

5.2.1 The selection of hot water supply system, should be determined according to the use requirements, heat consumption and distribution of water use points together with the conditions of heat source.

5.2.2 The industrial surplus heat, waste heat, terrestrial heat and solar energy should be utilized preferentially as heat source for central hot water supply system.

Note: 1 The temperature of flue gas and waste gas drawn in with waste boiler to make heating medium may not be lower than 400℃.

2 In the centralized hot water supply system where solar energy is utilized as heat source, a set of vapor heating equipment may be attached.

3 When local terrestrial heat is the heat source, technical measures should be adopted according to terrestrial hot water's temperature, quality and pressure.

5.2.3 When there are no conditions to utilize industrial surplus heat, waste heat or solar energy, it may preferentially adopt thermodynamic network which can guarantee yearly the heat supply as heat source of central hot water supply system.

5.2.4 When local boiler or nearby boiler may fully supply vapor or high temperature water, they may be adopted as the centralized hot water supply system heat medium.

5.2.5 When there are no conditions as Clause 5.2.2, 5.2.3, 5.2.4, described heat source can be utilized, burning oil, burning gas hot water machine set or electrical storage heat equipment etc. provide centralized hot water supply system's heat source or direct supply hot water.

5.2.6 Local hot water supply system's heat source, solar energy, electrical energy, gas burner, vapor may be adopted.

5.2.7 Cooling water after temperature raise, the water quality meets the demands of Clause 5.1.2 of this code, it may be the hot water for domestic use.

5.2.8 When waste heat (waste vapor, burning gas, high temperature no poisons waste fluid) is utilized as heat medium, the following measures should be taken:

1 Heating equipment should be anticorrosive, and its structure may be suitable for eliminating water stain and sediment.

2 To prevent the leakage of heat medium that will cause pollution of water quality.

3 To dispel the pressure fluctuation of waste vapor and remove grease.

5.2.9 When heat equipment in which vapor directly pass water or mix vapor and water is adopted, it may be taken in open system of hot water supply, and should meet following demands:

1 The vapor contains no oil and no poisonous material.

2 During heating noise killer should be installed, the noise produced should meet the demand of current "Standard of environmental noise of urban area".

3 When technological economical comparison estimates that non-collection condensation wa-

ter is rational.

4 To prevent hot water flow back to vapor pipeline, measures should be taken.

5.2.10 Central hot water supply system, hot water recycling pipe should be installed, this installation should meet following demands:

1 Hot water supply system should ensure hot water recycles in the main pipe and vertical pipe.

2 In the building hot water with no lower than the fixed temperature will be provided timely, should ensure hot water recycling in branch pipe or provided measure to ensure branch pipe hot water temperature.

5.2.11 Recycling pipeline should adopt same order arrangement, recycling pump is installed and adopt mechanical recycling.

5.2.12 In the building with central hot water supply system, bath room, laundry, kitchen etc. then water consumption is large, independent hot water supply system may be installed. When hot water is provided at regular time interval and some unit requires a special hot water providing time, independent hot water network or local heating equipments may be installed.

5.2.13 The division in districts of high building hot water supply system should comply with following principles:

1 It should be the same as that of water supply system, water heater, storage tank in every district should be provided input water by same district's water supply system special pipe supply, if it can not be satisfied, to ensure system's cold, hot water pressure steady measure should be taken.

2 When pressure relief valve is adopted for division of districts, it should meet Clause 3.4.10 demand of this code and also should ensure every district hot water recycling.

5.2.14 When the variation of water pressure in water supply pipe is large and water use points require a steady water pressure, open hot water supply system may be adopted or taken pressure steady measures.

5.2.15 When the sanitary fixture is equipped with cold hot water mixer or mixing faucet, in hot and cold water supply system the pressure at water distribution points should be the same.

5.2.16 Public bathroom shower fitting outlet water temperature should be steady and following measures should be taken:

1 Adopting open system for hot water supply.

2 Water consumption pipeline with large rated water supply flow, should be separated with shower bath distribution pipeline.

3 The distribution pipe linking more than 3 shower fittings, may be installed in a circular path.

4 The water head loss of distribution branching pipes of shower fittings in series throughout their way may be adopted as no more than 300Pa per meter when the number of shower fitting is 6 or less than 6 and no more than 350Pa when the number of shower fittings are more than 6. The diameter of distribution pipe may not be changed and the minimum must not be less than 25 mm.

5 One-pipeline hot water system may be used in living room of factory and washroom of school.

One-pipeline hot water system should take hot water temperature steady technological measure.

Note: Public washroom may not adopt public bathhouse bath type, if it must be adopted, recycling water treatment and disinfect equipment should be taken.

5.3 Calculation of heat consumption, hot water quantity and heating equipment hot supply

5.3.1 Design heat consumption of maximum hour calculation:

1 With central hot water supply system residential district's designed heat consumption of maximum hour, when public building maximum water using time section is identical with dwelling maximum water using time section, these two design heat consumption of maximum hour should be added in calculation, when is not identical, dwelling's design heat consumption of maximum hour and public building average hourly hot consumption should be added in calculation.

2 All day hot water supply dwelling, villa, rest house, training center, hotel, guest house customer room (exclude staffs), hospital sick room, house of respect for the Aged, kindergarten, crèche (with brooders) etc. buildings centralized hot water supply system design heat consumption of maximum hour should be calculated according to following formula:

Q_h = K_h * (m * q_r * C * (t_r - t_l) * rho_r) / 86400 (5.3.1-1)

- Where Q_h—Design heat consumption of maximum hour(W);
m—Number of calculated water using unit (number of person or bed);
q_r—Rated hot water consumption (L/person·d or L/bed·d) should adopt the figures in Table 5.1.1-1 of this code
C—Specific heat of water, C = 4187(J/kg·℃);
t_r—Temperature of hot water, t = 60(℃);
t_l—Temperature of cold water, adopt the figures in table 5.1.4 of this code;
rho_r—Hot water density (kg/L);
K_h—Hourly variation coefficient, may adopt the figures in Table 5.3.1-1 ~ Table 5.3.1-3.

Table 5.3.1-1 Dwelling, villa hot water hourly variation coefficient K_h value

Number of inhabitants (m)	≤100	150	200	250	300	500	1000	3000	≥6000
K_h	5.12	4.49	4.13	3.88	3.70	3.28	2.86	2.48	2.34

Table 5.3.1-2 Hotel hot water hourly variation coefficient K_h value

Number of bed (m)	≤150	300	450	600	900	≥1200
K_h	6.84	5.61	4.97	4.58	4.19	3.90

Table 5.3.1-3 Hospital hot water hourly variation coefficient K_h value

Number of bed (m)	≤50	75	100	200	300	500	≥1000
K_h	4.55	3.78	3.54	2.93	2.60	2.23	1.95

Note: Rest house, training center, guest house customer room (exclude staffs), house of respect for the Aged, kindergarten, crèche (with brooders)etc. buildings K_h may be selected referring to Table 5.3.1-2; office building K_h see Table 3.1.10.

3 Hot water supply at regular intervals, dwelling, hotel, hospital and industrial living quarter, public bathhouse, school, theater, stadium etc. buildings centralized hot water supply system design heat consumption of maximum hour should be calculated according to following formula:

$$Q_h = \sum \frac{q_h(t_r - t_l)\rho_r N_0 b C}{3600} \quad (5.3.1-2)$$

Where Q_h ——Design heat consumption of maximum hour(W);

q_h ——plumbing fixture hot water hourly rated water consumption (L/h), should be adopted according to Table 5.1.1-2 of this code;

C ——Specific heat of water, $C = 4187$ (J/kg·°C);

t_r ——Temperature of hot water adopted according to Table 5.1.1-2 of this code;

t_l ——Temperature of cold water, adopt the figures in Table 5.1.4 of this code;

ρ_r ——Hot water density (kg/L);

N_0 ——Number of plumbing fixture of same kind;

b ——Simultaneous using percentage of plumbing fixtures: dwelling, hotel, hospital, sanatorium, sick room, water closet, bath tub or shower sitting may be 70% ~ 100%, other fixtures not into account, but at regular interval continuous water supply duration should not be less than 2h. Industrial living quarter, public bathroom, school, theater, stadium etc. shower fitting and wash basin may be 100%. Dwelling one family with several water closets, only one will be taken into accounts.

4 With many different hot water using departments in a single building or with many using function comprehensive building, when the hot water is supplied from one and the same hot water supply system, design heat consumption of maximum hour may be calculated according to at the same time occurring water using peak of the principal water using department designed heat consumption of maximum hour plus other department's average hourly heat consumption.

5.3.2 Designed hourly hot water quantity may be calculated according to following formula:

$$q_{rh} = \frac{Q_h}{1.163(t_r - t_l)\rho_r} \quad (5.3.2)$$

Where q_{rh} ——Designed hourly heat water quantity (L/h);

Q_h ——Designed hourly heat consumption (W);

t_r ——Designed hot water temperature (°C);

t_l ——Designed cold water temperature (°C);

ρ_r ——Hot water density (kg/L).

5.3.3 Central hot water supply system, boiler, water heater, designed hourly heat supply should be determined according to daily hot water using quantity hourly change curve, heating method and boiler, water heater working system integrated curve. When is no condition, may be determined

according to following principles:

1 Volumetric water heater or heat storage tank and with the correspond water heater, hot water machine set, calculation may base upon following formula:

$$Q_g = Q_h - 1.163 \frac{\eta V_r}{T} (t_r - t_l) \rho_r \quad (5.3.3)$$

Where Q_g ——Volumetric water heater's designed hourly heat supply (W);

Q_h ——Design heat consumption of maximum hour(W);

η ——Coefficient of effective storage heat; volume volumetric water heater $\eta = 0.75$,
Guide way pattern volumetric water heater $\eta = 0.85$;

V_r ——Total storage heat volume (L);

T ——Design heat consumption of maximum hour duration time (h), $T = 2 \sim 4h$;

t_r ——Hot water temperature (°C), calculated base upon designed water heater outflow
water temperature or storage water temperature;

t_l ——Cold water temperature(°C), may adopt from table 5.1.4;

ρ_r ——Hot water density (kg/L).

2 Semi volumetric water heater or heat storage tank and with the correspond water heater, hot water machine set's heat supply may be calculated according to design heat consumption of maximum hour.

3 Semi instant heater, quick water heater and other water heater equipment without heat storage volume, its heat supply may be calculated according to designed second flow.

5.4 Water heating and storage

5.4.1 The selection of heating equipments should be determined according to using characteristics, heat consumption, heat source, maintenance management and sanitary disinfectant etc. factors, and meet following demands:

- 1 High heat efficiency, good heat exchange, save energy, save the space of equipment room;
- 2 Domestic hot water less lose of side resistance, benefit to whole system's pressure equilibrium of cold, hot water;
- 3 Safe reliable, simple structure, convenience for operation, maintenance.

5.4.2 Selection of water heating equipment should comply with following principles:

1 When self energizing heat source is adopted, direct hot water supply with fuel of burning gas, burning oil etc. combustion hot water machine set may be adopted, indirect hot water supply with self heat exchange hot water machine set or attached volumetric or semi-volumetric water heating equipment hot water machine set also may be adopted.

2 Hot water machine set should meet the demands of Clause 5.4.1, it should provide with complete combustion, smoke abatement dust extract, machine set water cover to the air, auto control water temperature, flame transducer, auto-alarm etc. functions.

3 When vapor, high temperature water is adopted as heat medium, uniformity of water use, hardness of water quality, supply of heat medium, system demand of cold got water pressure equilibrium and the sensibility, reliability of temperature control, safety device of equipment etc, all these comprehensive technological and economical comparison should be conducted afterward to select the indirect water heating equipment.

4 When solar energy is the heat source, heat pipe or vacuum tube solar energy heater may be adopted.

5 Region with rich electricity supply, electrical water heater may be adopted.

5.4.3 Boiler or water heater of hot water supply system of hospital must not be less than 2 sets, other building's hot water supply system water heating equipment may not be less than 2 sets, when one set is in repair, the other's total heat supply capacity must not be less than 50% of the design heat consumption of maximum hour.

Hospital building must not adopt volumetric water heater with stagnant zone.

5.4.4 Selection of part hot water supply equipment should meet following demands:

1 Equipment selection should comprehensively consider heat source condition, character of building, location of equipment, safety demand and specified function of equipment etc. factors.

2 When hot water supply to many plumbing fixtures or equipments simultaneously, volumetric plumbing heating equipment may be selected.

3 When solar energy is rich in this region, solar energy water heater or solar energy complement electric heating water heater may be selected.

4 Water heater should not be installed at combustible material stack or places with gas pipe, meter or electrical equipments effected area and with corrosive gas and dust.

5.4.5 **Burning gas water heater, electric water heater must be attached with equipments safety use guarantee. Installation of direct exhausted burning gas water heater which can accumulate poison gas in the occupation space are strictly prohibited in the bathroom.**

5.4.6 Surface type water heater heating area should be calculated according to following formula:

$$F_{jr} = \frac{C_r Q_z}{\epsilon K \Delta t_j} \quad (5.4.6)$$

Where F_{jr} ——Heat area of surface type water heater (m^2);

Q_z ——Required heat for producing for hot water (W);

K ——Coefficient of heat transfer ($W/m^2 \cdot C$);

ϵ ——Coefficient effecting heat transfer efficiency as the uneven distribution of incrustation and hot medium, generally it is 0.6 ~ 0.8;

Δt_j ——Calculated temperature difference ($^{\circ}C$) between heat medium and heated water which should be determined according to Clause 5.4.7 in this code

C_r ——Heat loss coefficient of hot water supply system, generally it is 1.1 ~ 1.15.

5.4.7 The calculated temperature difference between heat medium of water heater and heated

water should be calculated according to following formula:

- 1 Volumetric type water heater, semi volumetric type water heater:

$$\Delta t_j = \frac{t_{mc} + t_{mz}}{2} - \frac{t_c + t_z}{2} \quad (5.4.7-1)$$

Where Δt_j ——Calculated temperature difference (°C);

t_{mc}, t_{mz} ——Original temperature and terminal temperature of heat medium (°C);

t_c, t_z ——Original temperature and terminal temperature of heated water(°C).

- 2 High speed water heater, semi-instant water heater:

$$\Delta t_j = \frac{\Delta t_{\max} - \Delta t_{\min}}{\ln \frac{\Delta t_{\max}}{\Delta t_{\min}}} \quad (5.4.7-2)$$

Where Δt_j ——Calculated temperature difference (°C) ;

$\Delta t_{\max}$ ——Maximum temperature difference between heat medium and heated water on one end of water heater (°C);

$\Delta t_{\min}$ ——Minimum temperature difference between heat medium and heated water on other end of water heater (°C).

5.4.8 The calculated temperature of heat medium should comply with following regulations:

- 1 Heat medium is vapor and its pressure is greater than 70kPa, the calculated temperature should be calculated according to saturated steam temperature, when pressure is less than or equals to 70 kPa, then should be 100°C.

- 2 When heat medium is hot water of thermodynamical network, it should be calculated according to the lowest temperature of supply water and returning water, but the difference between the original temperature of the heat medium and the terminal temperature of heated water must not be less than 10°C.

5.4.9 To calculate the volume of volumetric type water heater or heated water tank the added coefficient should comply with following regulations:

- 1 When cold water comes in downward and hot water goes out upward, the calculated volume may be added by 20% ~ 25%.

- 2 When guide way type volumetric water heater is adopted, the calculated volume should be added by 10% ~ 15%.

- 3 When semi-volumetric type water heater is adopted or volumetric water heater with compulsory water circulation equipment, the calculated volume may not be added.

5.4.10 Storage tank volume of central hot water supply system should be determined by calculation according to integral curve on the basis of hourly variation curve of daily hot water consumption, operation system of boiling water heater and water heater, heat supply capacity and auto-temperature control equipment etc. factors.

- 1 Volumetric type water heater or heated water tank, semi-volumetric water heater's storage heat capacity should be not less than Table 5.4.10 demands.

Table 5.4.10 Heat capacity of water heater

Heating equipment	Vapor or hot water of temperature higher than 95℃ as heat medium		Low temperature water not higher than 95℃ as heat medium	
	Shower bath room of industrial enterprise	Other buildings	Shower bath room of industrial enterprise	Other buildings
Volumetric water heater or heated water tank	$\geq 30\min Q_h$	$\geq 45\min Q_h$	$\geq 60\min Q_h$	$\geq 90\min Q_h$
Storage type heat exchanger of guide flow type	$\geq 20\min Q_h$	$\geq 30\min Q_h$	$\geq 30\min Q_h$	$\geq 40\min Q_h$
Semi-volumetric type water heater	$\geq 15\min Q_h$	$\geq 15\min Q_h$	$\geq 15\min Q_h$	$\geq 20\min Q_h$

Note:1 Hot water machine set attached distribution storage equipment, its heat capacity may be determined base upon supply condition of heat medium, according to guide way type volumetric water heater or semi-volumetric water heater.

2 Q_h is design heat consumption of maximum hour(W).

2 Semi-instant type, quick type water heater, when heat medium is based upon design second flow, and provided with well-equipped reliable temperature auto-control equipment, storage tank is not needed. When above-mentioned condition is not existed, storage should be installed and its storage heat capacity should be determined based upon heat medium supply condition according to guide way type volumetric water heater or semi-volumetric water heater.

5.4.11 Replenishing cold water tank should be installed for elevated heating, storage heat hot water tank with continuously heating of hot water supply system.

Note: When there is cold water tank that can supply cold water for hot water supply system, the replenishing cold water tank may not be installed.

5.4.12 The installation height of replenishing cold water tank (count from tank bottom) should ensure the required water pressure of the most unfavorable water distribution point.

5.4.13 Installation of replenishing cold water pipe should meet following demands:

1 The diameter of replenishing cold water pipe should be determined according to the designed second flow of hot water supply system.

2 The replenishing cold water pipe should not supply water to other use except to heating equipment, heated water tank and hot water storage tank.

3 In the hot water supply system with heat carrier circulation, replenishing cold water pipe should be connected with the hot water storage tank and must not be connected with the returning water pipe of heat carrier circulation, the boiler or hot water machine set.

5.4.14 Hot water tank should provide with cover, overflow pipe, sluice pipe and vent pipe leading to the outside. The height of overflow level at hot water storage over the height of the replenishing cold water tank level should be calculated according to the water expansibility. Sluice pipe and overflow pipe must not be linked directly with the drainage pipe.

5.4.15 Water heating equipment and heat storage equipment vessels according to water quality and use condition demands should adopt anti-corrosive material or provide with anti-corrosive lining

on the inside surface of steel vessel.

5.4.16 Arrangement of water heat equipments should comply with following demands:

1 Volumetric type, guide flow volumetric type, semi-volumetric type heat exchanger on one side a passage way with clear width should be not less than 0.7m. These should be a position on the front end of the passage way in order to take out the heat disk pipe.

2 The clear distance between the highest point of accessories upon the water heater and the lowest point of the building structure should meet the repair requirement, but should not be less than 0.2m, the clear height of room must not be less than 2.2m.

5.4.17 Arrangement of hot water machine set should comply with following demands:

1 Hot water machine set room may be managed individually separated from other buildings. When machine room is managed inside the building, it should be away from person's concentration area up, down and adjacent, and emergency exit should be provided.

2 Arrangement of machine room should meet equipment's installation, operation and maintenance demands, its front part a space should be kept not less than the 2/3 of machine set length, its back part a space should be kept with 0.8 ~ 1.5m, two side passage way width should be the width of machine set, and be not less than 1.0m. The clear distance between upper part of accessory of machine set (except chimney) and machine room bottom surface of beam of roof slab may not be less than 0.8m.

3 Machine room and hot water machine set attached oil vessel, storage oil tank, their arrangement and layout of oil supply, gas supply pipeline all should meet the relevant fire proof, safety demands.

5.4.18 The room with boiler, hot water machine set, water heater, water heat storage tank should be convenient for water sluicing and prevent sewage back flow and provided with well ventilation and illumination.

5.4.19 Expansion pipe should be installed in the open system for hot water, management of expansion pipe should meet flowing demands:

1 When hot water system is supplied by potable water elevated tank, the expansion may be bridged over another elevated tank except non-potable water tank in the same building and its height may be calculated by Formula 5.4.19.

$$h = H \left(\frac{\rho_l}{\rho_r} - 1 \right) \quad (5.4.19-1)$$

Where h ——Vertical height of expansion pipe over the water level of potable water elevated tank (m);
 H ——Height from the bottom of boiler, water heater to the water level of elevated water tank (m);

ρ_l ——Specific density of cold water (kg/m^3);

ρ_r ——Specific density of hot water (kg/m^3).

outlet of expansion pipe may not be less than 100mm high above the tank water level.

2 If expansion water tank is managed to the hot water supply system, its volume should be

calculated according to formula 5.4.19-2; When water level of expansion water tank is higher than the water level of system cold water supply water tank, the height is calculated according to Formula 5.4.19-3.

$$V_p = 0.0006\Delta t V_s \quad (5.4.19-2)$$

Where V_p ——Effective volume of expansion tank (L);
 Δt ——Maximum temperature difference in the system (°C);
 V_s ——Water volume of the system (L).

$$h = H \left(\frac{\rho_h}{\rho_r} - 1 \right) \quad (5.4.19-3)$$

Where h ——Vertical height of expansion water tank water level is higher than the system cold water supply tank water level;
 H ——Height of boiler, water heater bottom to system cold water supply tank water level (m);
 ρ_h ——Hot water back water density (kg/m³);
 ρ_r ——Hot water supply water density (kg/m³);
 3 When expansion pipe may be frozen, heat preservation measures should be taken.
 4 Minimum diameter of expansion pipe may be determined according to Table 5.4.19.

Table 5.4.19 Minimum diameter of expansion pipe

Heat transfer area of boiler or water heater (m ²)	< 10	≥ 10 and < 15	≥ 15 and < 20	≥ 20
Minimum diameter of expansion pipe (mm)	25	32	40	50

Note: There are many boilers or water heaters, expansion pipe may be provided separately for each one.

5.4.20 Valve must not be installed on the expansion pipe.

5.4.21 At close type hot water supply system, pressure expansion tank, pressure relief valve should be installed and should meet following demands:

1 Daily hot water consumption is less than or equals to 10m³, hot water supply system pressure relief valve should be taken as pressure relief measures.

2 Daily hot water consumption is greater than 10m³, hot water supply system pressure expansion tank should be installed. Total volume of expansion tank should be calculated according to Formula 5.4.21.

$$V_e = \frac{(\rho_f - \rho_r) P_2}{(P_2 - P_1) \rho_r} V_s \quad (5.4.21)$$

Where V_e ——Total volume of expansion tank (m³);
 ρ_f ——Water density of storage equipment before heating (kg/m³),
 when there is only one set heating equipment, and with constant hot water supply system, it may be determined base upon cold water temperature, when there are many set heating equipments and with central hot water supply system, it may be determined base upon hot water return back water temperature.

ρ_r ——Density of hot water (kg/m^3);

P_1 ——Expansion tank pipe water pressure (MPa, absolute pressure), it is the pipe working pressure + 0.1 (MPa);

P_2 ——Expansion tank pipe maximum allowable pressure (MPa, absolute pressure), its value may be $1.05P_1$;

V_s ——Hot water total volume of the system (m^3).

3 Expansion tank may be installed on cold water inlet or hot water return water pipe of heating equipment.

5.5 Calculation of network

5.5.1 Residential district with central hot water supply system, its outdoor hot water main pipe designed flow may be calculated determined according to Clause 3.6.1 in this code.

Building's hot water inlet pipe may be determined according to building's correspond hot water supply system's main pipe's designed second flow.

5.5.2 Buildings indoor hot water supply network designed second flow may be respectively calculated according to Clause 3.6.4, 3.6.5, 3.6.6 in this code.

5.5.3 Plumbing fixture hot water supply rated flow, equivalent, branch pipe diameter and minimum working pressure should comply with Clause 3.1.4 regulation in this code.

5.5.4 Head loss calculation of hot water network should comply with following regulations:

1 Head loss of unit length should be determined according to Clause 3.6.10 in this code, the calculated interior diameter of pipe d_j should consider the decrease of cross section area due to incrustation and corrosion factors.

2 Partial water head loss may be determined by calculation according to Clause 3.6.11 in this code.

5.5.5 Hot water circulation flow of all-day hot water supply system should be calculated according to following formula:

$$q_x = \frac{Q_s}{1.163\Delta t} \quad (5.5.5)$$

Where q_x ——All-day hot water supply circulation flow (L/h);

Q_s ——Heat loss of distribution pipe (W) determined by calculation, generally may adopt 3% ~ 5% of design heat consumption of maximum hour;

Δt ——Temperature difference of hot water in distribution water pipe ($^{\circ}\text{C}$), determined according to scope of system, generally adopt 5 ~ 10 $^{\circ}\text{C}$.

5.5.6 Hot water circulating flow of timely hot water supply system may be calculated according to 2 ~ 4 times circulation per hour of the water in the circulation network system.

5.5.7 In the hot water supply system, the temperature difference between the temperature of the outlet water of boiler or water heater and the lowest water temperature at the point of distribution

must not be greater than 15℃.

5.5.8 Hot water pipe's flow velocity may be selected according to Table 5.5.8.

Table 5.5.8 Hot water pipe flow velocity

Nominal diameter (mm)	15 ~ 20	25 ~ 40	≥ 50
Flow velocity (m/s)	≤ 0.8	≤ 1.0	≤ 1.2

5.5.9 Hot water return pipe diameter of hot water supply system with circulation system, should be determined by hydraulic calculation according to pipe circulation flow.

5.5.10 In the hot water supply system with mechanical circulation, the circulating pump should meet following requirements:

- 1 Pump outflow should be the circulating flow.
- 2 Pump head should be calculated according to flowing formula:

$$H_b = h_p + h_x \quad (5.5.10)$$

Where H_b ——Circulating pump head(kPa);

h_p ——Head loss of circulating flow passing through distribution pipe net (kPa);

h_x ——Head loss of circulating flow passing through return pipe net (kPa)。

Note: When calculate pump head of semi-instantaneous heater or instantaneous heater, loss of head should be counted.

3 Circulating pump should be selected as hot water pump, pump case stands working pressure which may not be less than static water pressure plus pump head.

4 Stand-by pump may be prepared for circulating pump alternate operation.

5 All-day hot water supply system, the circulating pump should be controlled to stop by pump's return pipe temperature.

5.5.11 Hot water pressurized pump's arrangement should comply with demands of Clause 3.8 in this code.

5.5.12 The natural pressure value of first circulation pipe should be calculated according to the following formula:

$$H_{\text{nr}} = 10 \cdot \Delta h (\rho_h - \rho_r) \quad (5.5.12)$$

Where H_{nr} ——Natural pressure value of the first circulating pipe (Pa);

Δh ——Difference of elevations between the center of boiler or water heater and center of water storage tank (m);

ρ_h ——Density of water storage tank return water (kg/m^3);

ρ_r ——Density of boiler water or water heater outlet water (kg/m^3).

5.6 Pipe, fitting and pipeline laying

5.6.1 Pipe and fitting of hot water system, should comply with current product standard demands. Working pressure and working temperature of pipeline must not exceed the allowable working pressure and working temperature of product standard limitation.

5.6.2 Anti-corrosive and convenient installation connection and reliable pipe should be selected as hot water supply line, thin walled copper pipe, thin walled stainless steel pipe, plastic hot water pipe, plastic and metallic complex hot water pipe etc. may be selected.

When plastic hot water pipe or plastic and metallic complex hot water pipe is selected, it should comply with following demands:

1 Working pressure of pipeline should be selected according to under corresponding temperature its permitted allowable working pressure.

2 Plastic hot water pipe should not be adopted in the equipment machine room.

5.6.3 Hot water system, compensating pipeline for expansion and contraction measure should be provided.

5.6.4 In the upfeed system air-discharge device should be installed at the highest point of distribution main pipe, in the downfeed system, the highest distribution point may be utilized for air discharge use; system's lowest point sluice device should be installed.

5.6.5 In the downfeed system with circulating pipe, its vertical returning pipe should be connected with vertical water distribution pipe below the highest water distribution point (approximately 0.5m). In the upfeed system, it is only needed that circulation pipe will be linked with each vertical pipes.

5.6.6 Hot water system various kinds valve's material and valve type should comply with requirements Clause 3.4.4, 3.4.5, 3.4.7, 3.4.9, 3.4.10 in this code.

5.6.7 Hot water pipe network valve should be installed on the following pipe sections:

- 1 Branch main pipe connects with distribution, return water main pipe;
- 2 Distribution water vertical pipe and return water vertical pipe;
- 3 Branch pipe connects from vertical pipe;
- 4 Distribution branch pipe with 3 or more than 3 distribution points;
- 5 Connection pipe section with water heater, water treatment equipment and temperature, pressure control valve set, according to demands valves are installed.

5.6.8 The hot water network should be provided with check valve on the following pipe sections:

- 1 Cold water supply pipe of water heater or storage tank;
- 2 Returning pipe of second circulation in mechanical circulation;
- 3 Cold, hot water supply pipe of cold hot water mixer.

5.6.9 Outflow temperature of water heater should be controlled with self-temperature regulation device adopted different demand of temperature accuracy grade according to use storage heat regulator volume or not.

5.6.10 Upper part of water heater inlet, outlet pipe of heat medium, storage hot water tank and cold hot water mixer, thermometer, pressure gauge should be installed; hot water circulation inlet pipe, thermometer and temperature conductor for circulation pump's on-off controller should be installed; thermometer water level gauge should be installed in hot water tank; safety valve should be installed in pressure vessel equipment, connecting pipe diameter of safety valve should be

determined by calculation, and should comply with relevant regulation of boiler and pressure vessels, sluice pipe of safety valve should draw to safety place and valve must not be installed on sluice pipe.

5.6.11 If the total quantity of hot water consumption is needed to be measured, cold water meter may be installed on the cold water supply pipe of water heater, hot water meter may be installed in the special supply branch for water consumption point in series and single consumption point. Dwelling with central hot water supply family branch hot water meter should be installed. Type, calculation and management of water meter should comply with Clause 3.4.17, 3.4.18, 3.4.19 in this code.

5.6.12 The slope of hot water horizontal pipe may not be less than 0.0003.

5.6.13 Plastic hot water pipe may be concealed installation, when it is exposed installation, vertical pipe may be arranged at the place not be collided, if it is not avoided, protection measure should be provided outside the pipe.

5.6.14 Insulation measures should be taken for the protection of hot water boiler, hot water machine set, water heating equipment, storage tank, distribution tank, hot water supply (distribution) pipe, circulation return main (vertical) pipe, thickness of insulation should be determined by calculation.

5.6.15 Hot water pipe should be provided with casing when it pass through building, floor, foundation, and provided with waterproof casing when pass through roof and basement exterior wall.

5.6.16 Laying of hot water pipe should comply with relevant clause of section 3.5 of this code.

5.6.17 Steam trap should be provided with each condensed water return pipe of water heater which is indirectly heated by vapor heat medium, when heat exchange of water heater can confirm condensed return water temperature less than 80℃, steam trap may not be installed. Lowest part of vapor vertical pipe, vapor pipe concave lower part, steam trap may be arranged.

5.6.18 Diameter of steam trap should be determined by calculation, filter should be installed in its front part, by-pass valve may be attached.

5.7 Potable water supply

5.7.1 The rated consumption and hourly variation coefficient of potable water according to function of building and local condition should be determined according to Table 5.7.1.

Table 5.7.1 Rated consumption and hourly variation coefficient of potable water

Building name	Unit	Rated consumption(L)	K_h
Workshop with high temperature	Each person each shift	3 ~ 5	1.5
General Workshop	Each person each shift	2 ~ 4	1.5
Living room in factory	Each person each shift	1 ~ 2	1.5
Office building	Each person each shift	1 ~ 2	1.5

Table 5.7.1(Continued)

Building name	Unit	Rated consumption(L)	K_h
Dormitory	Each person each day	1 ~ 2	1.5
Building of teaching	Each student each shift	1 ~ 2	2.0
Hospital	Each sick bed each day	2 ~ 3	1.5
Theater cinema	Each audience each show	0.2	1.0
Inn guest house and hotel	Each guest each day	2 ~ 3	1.5
Gymnasium and stadium	Each audience each show	0.2	1.0

Note: Hourly variation coefficient indicates the variation coefficient in the potable water supply time.

5.7.2 Fine drinking water supply system of residential district, dwelling, villa, rated consumption may be 4 ~ 7 L/per person per day, hourly variation coefficient may be 6.

5.7.3 Fine drinking water system should meet following demands:

1 Fine drinking water may be made of municipal supply as raw water passing through deep treatment method; its quality should meet the demands of current "Water quality standard for fine drinking water".

2 Fine drinking water drinker's rated flow may be 0.04L/sec, the lowest working pressure is 0.03 MPa.

3 Velocity regulated pump set may be adopted for fine drinking water with direct water supply type.

4 High-rise building fine drinking water system should be divided into districts vertically, each district lowest distribution point hydraulic pressure may not be greater than 0.35 MPa and must not be greater than 0.45MPa.

5 Potable water should provide with circulation pipeline, circulation network water retaining time may not exceed 6h. From vertical pipe connects with distribution tap, the branch pipe length should take the shortest.

6 Designed second flow of fine drinking water system distribution pipe should be calculated according to following formula:

$$q_g = q_0 m \quad (5.7.3)$$

Where q_g ——Designed second flow of calculated pipe section (L/s);

q_0 ——Rated flow of drinker, take 0.04 (L/s);

m ——Number of drinker use simultaneously at the calculated pipe section determined according to appendix D.

7 Pipe flow velocity should be according to Clause 5.5.8 in this code.

8 Head loss of fine drinking water should be calculated according to Clause 3.6.10, 3.6.11 of this code.

5.7.4 Boiling water supply should meet following standards:

1 Calculated temperature of boiling water should be calculated according to 100℃,

calculated temperature of cold water should comply with Clause 5.1.4.

2 Vent pipe of boiling water equipment should lead to outdoor.

3 Screwed plug may be installed on distribution tap.

4 Boiling water equipment should install thermometer and water level gauge, boiling water boiler should install thermometer, when necessary should install boiling water tank or safety valve.

5.7.5 Middle primary school, gymnasium stadium etc. public building drinking vessel should comply with following demands:

1 The warm water or tap water is the raw water of drinking water should be filtered and disinfested.

2 Circulating pipeline should be provided, circulation return water should be disinfected.

3 Drinker's spray nozzle should be installed inclined and with protection device, the height of spray nozzle is enough so that it can't be submerged when drainage pipe is block up.

4 Pressure of spray nozzle in a series should be uniform.

5 Drinking vessel should be stainless steel, copper chrome plated or enamelized, enamel product, its surface should be smooth and easy to clean.

5.7.6 Drinking water pipe should select anti-corrosion, smooth interior surface, comply with food level sanitary demands, thin wall stainless steel pipe, thin wall copper pipe, high quality plastic pipe. Boiling water pipeline should select metallic pipe, its working temperature is greater than 100℃.

5.7.7 Valve, water meter, fittings, concealed material, distribution tap etc., its quality should comply with food level sanitary demands and same as pipe materials.

5.7.8 The distribution of drinking water point should meet following demands:

1 It can't be in the place where the water is easy to be polluted, for the workshop which often produce poisonous gases or dust, it should be in the living room or cabinet not subject to be polluted.

2 It should be in the place convenient for getting water, examining and cleaning and good ventilation and lighting equipment should be installed.

3 In storied building, it should be determined according to local condition for using.

5.7.9 Boiling water room, drinking water treatment room should install water supply pipe, drainage floor drain. Water supply pipe diameter may be calculated according to designed hourly drinking water consumption. Boiling water equipment, boiler drainage, drain pipe should adopt metallic drainpipe or heating resisting plastic drainpipe.

Appendix A Residential district underground pipeline (structure) minimum net clearance between lines

Table A Residential district underground pipeline (structure) minimum net clearance between lines

Kind of pipe Net clearance (m)	Water supply pipe		Sewer		Rainwater pipe	
	Horizontal	Vertical	Horizontal	Vertical	Horizontal	Vertical
Water supply pipe	0.5 ~ 1.0	0.1 ~ 0.15	0.8 ~ 1.5	0.1 ~ 0.15	0.8 ~ 1.5	0.1 ~ 0.15
Sewer	0.8 ~ 1.5	0.1 ~ 0.15	0.8 ~ 1.5	0.1 ~ 0.15	0.8 ~ 1.5	0.1 ~ 0.15
Rainwater pipe	0.8 ~ 1.5	0.1 ~ 0.15	0.8 ~ 1.5	0.1 ~ 0.15	0.8 ~ 1.5	0.1 ~ 0.15
Low pressure gas pipe	0.5 ~ 1.0	0.1 ~ 0.15	1.0	0.1 ~ 0.15	1.0	0.1 ~ 0.15
Buried hot water pipe	1.0	0.1 ~ 0.15	1.0	0.1 ~ 0.15	1.0	0.1 ~ 0.15
Heating ditch	0.5 ~ 1.0		1.0		1.0	
Tree center	1.0		1.5		1.5	
Electric power cable	1.0	Buried 0.5 Cased 0.25	1.0	Buried 0.5 Cased 0.25	1.0	Buried 0.5 Cased 0.25
Telecommunication cable	1.0	Buried 0.5 Cased 0.15	1.0	Buried 0.5 Cased 0.15	1.0	Buried 0.5 Cased 0.15
Tele and illumination cable	0.5		1.0		1.0	

- Note: 1 Net clearance indicates distance between pipe exterior walls, pipe crossing with casing pipe it indicated distance between casing pipe exterior walls, buried heating pipe it indicates the distance between heat insulating casing pipe exterior walls.
- 2 Electric power cable laying at road east side (north-southward road) or south side (east-westward road); Tele cables are lying at west side or north side, generally lay under pedestrianway.

Appendix B Valves and screw fittings resistance loss converted length of compensation

Table B Valves and screw fittings resistance loss converted length of compensation

Interior diameter of fitting	Various kinds of fittings converted pipe length (m)						
	90° standard bent	45° standard bent	Standard T 90° angle flow	T straight flow	Gate plate valve	Ball valve	Angle valve
9.5	0.3	0.2	0.5	0.1	0.1	2.4	1.2
12.7	0.6	0.4	0.9	0.2	0.1	4.6	2.4
19.1	0.8	0.5	1.2	0.2	0.2	6.1	3.6
25.4	0.9	0.5	1.5	0.3	0.2	7.6	4.6
31.8	1.2	0.7	1.8	0.4	0.2	10.6	5.5
38.1	1.5	0.9	2.1	0.5	0.3	13.7	6.7
50.8	2.1	1.2	3.0	0.6	0.4	16.7	8.5
63.5	2.4	1.5	3.6	0.8	0.5	19.8	10.3
76.2	3.0	1.8	4.6	0.9	0.6	24.3	12.2
101.6	4.3	2.4	6.4	1.2	0.8	38.0	16.7
127.0	5.2	3.0	7.6	1.5	1.0	42.6	21.3
152.4	6.1	3.6	9.1	1.8	1.2	50.2	24.3

Note: Screw joints in this table are fittings with not concave screw, that is fitting and pipe connecting point with sudden change of interior diameter, the interior diameter of fitting is greater than pipe interior diameter. When fitting are concave screw, or fitting and pipe jointed by welding with same diameter, the compensating length valve will take the half of this table.

**Appendix C Water supply pipe section Plumbing fixtures water
supply equivalent simultaneously outflow probability
calculated equation, α_c coefficient values table**

Table C $U_0 \sim \alpha_c$ value correspond table

$U_0(\%)$	α_c
1.0	0.00323
1.5	0.00697
2.0	0.01097
2.5	0.01512
3.0	0.01939
3.5	0.02374
4.0	0.02816
4.5	0.03263
5.0	0.03715
6.0	0.04629
7.0	0.05555
8.0	0.06489

Appendix D Water supply pipe section designed second flow calculation table

Table D-1 Water supply pipe section designed second flow calculation table [U : (%); q : (L/s)]

U_0	1.0		1.5		2.0		2.5	
N_g	U	q	U	q	U	q	U	q
1	100.00	0.20	100.00	0.20	100.00	0.20	100.00	0.20
2	70.94	0.28	71.20	0.28	71.49	0.29	71.78	0.29
3	58.00	0.35	58.30	0.35	58.62	0.35	58.96	0.35
4	50.28	0.40	50.60	0.40	50.94	0.41	51.30	0.41
5	45.01	0.45	45.34	0.45	45.69	0.46	46.06	0.46
6	41.12	0.49	41.45	0.50	41.81	0.50	42.18	0.51
7	38.09	0.53	38.43	0.54	38.79	0.54	39.17	0.55
8	35.65	0.57	35.99	0.58	36.36	0.58	36.74	0.59
9	33.63	0.61	33.98	0.61	34.35	0.62	34.73	0.63
10	31.92	0.64	32.27	0.65	32.64	0.65	33.03	0.66
11	30.45	0.67	30.80	0.68	31.17	0.69	31.56	0.69
12	29.17	0.70	29.52	0.71	29.89	0.72	30.28	0.73
13	28.04	0.73	28.39	0.74	28.76	0.75	29.15	0.76
14	27.03	0.76	27.38	0.77	27.76	0.78	28.15	0.79
15	26.12	0.78	26.48	0.79	26.85	0.81	27.24	0.82
16	25.30	0.81	25.66	0.82	26.03	0.83	26.42	0.85
17	24.56	0.83	24.91	0.85	25.29	0.86	25.68	0.87
18	23.88	0.86	24.23	0.87	24.61	0.89	25.00	0.90
19	23.25	0.88	23.60	0.90	23.98	0.91	24.37	0.93
20	22.67	0.91	23.02	0.92	23.40	0.94	23.79	0.95
22	21.63	0.95	21.98	0.97	22.36	0.98	22.75	1.00
24	20.72	0.99	21.07	1.01	21.45	1.03	21.85	1.05
26	19.92	1.04	20.27	1.05	20.65	1.07	21.05	1.09
28	19.21	1.08	19.56	1.10	19.94	1.12	20.33	1.14
30	18.56	1.11	18.92	1.14	19.30	1.16	19.69	1.18
32	17.99	1.15	18.34	1.17	18.72	1.20	19.12	1.22
34	17.46	1.19	17.81	1.21	18.19	1.24	18.59	1.26
36	16.97	1.22	17.33	1.25	17.71	1.28	18.11	1.30
38	16.53	1.26	16.89	1.28	17.27	1.31	17.66	1.34

Table D-1 (Continued)

U_0	1.0		1.5		2.0		2.5	
N_g	U	q	U	q	U	q	U	q
40	16.12	1.29	16.48	1.32	16.86	1.35	17.25	1.38
42	15.74	1.32	16.09	1.35	16.47	1.38	16.87	1.42
44	15.38	1.35	15.74	1.39	16.12	1.42	16.52	1.45
46	15.05	1.38	15.41	1.42	15.79	1.45	16.18	1.49
48	14.74	1.42	15.10	1.45	15.48	1.49	15.87	1.52
50	14.45	1.45	14.81	1.48	15.19	1.52	15.58	1.56
55	13.79	1.52	14.15	1.56	14.53	1.60	14.92	1.64
60	13.22	1.59	13.57	1.63	13.95	1.67	14.35	1.72
65	12.71	1.65	13.07	1.70	13.45	1.75	13.84	1.80
70	12.26	1.72	12.62	1.77	13.00	1.82	13.39	1.87
75	11.85	1.78	12.21	1.83	12.59	1.89	12.99	1.95
80	11.49	1.84	11.84	1.89	12.22	1.96	12.62	2.02
85	11.15	1.90	11.51	1.96	11.89	2.02	12.28	2.09
90	10.85	1.95	11.20	2.02	11.58	2.09	11.98	2.16
95	10.57	2.01	10.92	2.08	11.30	2.15	11.70	2.22
100	10.31	2.06	10.66	2.13	11.04	2.21	11.44	2.29
110	9.84	2.17	10.20	2.24	10.58	2.33	10.97	2.41
120	9.44	2.26	9.79	2.35	10.17	2.44	10.56	2.54
130	9.08	2.36	9.43	2.45	9.81	2.55	10.21	2.65
140	8.76	2.45	9.11	2.55	9.49	2.66	9.89	2.77
150	8.47	2.54	8.83	2.65	9.20	2.76	9.60	2.88
160	8.21	2.63	8.57	2.74	8.94	2.86	9.34	2.99
170	7.98	2.71	8.33	2.83	8.71	2.96	9.10	3.09
180	7.76	2.79	8.11	2.92	8.49	3.06	8.89	3.20
190	7.56	2.87	7.91	3.01	8.29	3.15	8.69	3.30
200	7.38	2.95	7.73	3.09	8.11	3.24	8.50	3.40
220	7.05	3.10	7.40	3.26	7.78	3.42	8.17	3.60
240	6.76	3.25	7.11	3.41	7.49	3.60	7.88	3.78
260	6.51	3.28	6.86	3.57	7.24	3.76	7.63	3.97
280	6.28	3.52	6.63	3.72	7.01	3.93	7.40	4.15
300	6.08	3.65	6.43	3.86	6.81	4.08	7.20	4.32
320	5.89	3.77	6.25	4.00	6.62	4.24	7.02	4.49
340	5.73	3.89	6.08	4.13	6.46	4.39	6.85	4.66
360	5.57	4.01	5.93	4.27	6.30	4.54	6.69	4.82
380	5.43	4.13	5.79	4.40	6.16	4.68	6.55	4.98
400	5.30	4.24	5.66	4.52	6.03	4.83	6.42	5.14

Table D-1(Continued)

U_0	1.0		1.5		2.0		2.5	
N_g	U	q	U	q	U	q	U	q
420	5.18	4.35	5.54	4.65	5.91	4.96	6.30	5.29
440	5.07	4.46	5.42	4.77	5.80	5.10	6.19	5.45
460	4.97	4.57	5.32	4.89	5.69	5.24	6.08	5.60
480	4.87	4.67	5.22	5.01	5.59	5.37	5.98	5.75
500	4.78	4.78	5.13	5.13	5.50	5.50	5.89	5.89
550	4.57	5.02	4.92	5.41	5.29	5.82	5.68	6.25
600	4.39	5.26	4.74	5.68	5.11	6.13	5.50	6.60
650	4.23	5.49	4.58	5.95	4.95	6.43	5.34	6.94
700	4.08	5.72	4.43	6.20	4.81	6.73	5.19	7.27
750	3.95	5.93	4.30	6.46	4.68	7.02	5.07	7.60
800	3.84	6.14	4.19	6.70	4.56	7.30	4.95	7.92
850	3.73	6.34	4.08	6.94	4.45	7.57	4.84	8.23
900	3.64	6.54	3.98	7.17	4.36	7.84	4.75	8.54
950	3.55	6.74	3.90	7.40	4.27	8.11	4.66	8.85
1000	3.46	6.93	3.81	7.63	4.19	8.37	4.57	9.15
1100	3.32	7.30	3.66	8.06	4.04	8.88	4.42	9.73
1200	3.09	7.65	3.54	8.49	3.91	9.38	4.29	10.31
1300	3.07	7.99	3.42	8.90	3.79	9.86	4.18	10.87
1400	2.97	8.33	3.32	9.30	3.69	10.34	4.08	11.42
1500	2.88	8.65	3.23	9.69	3.60	10.80	3.99	11.96
1600	2.80	8.96	3.15	10.07	3.52	11.26	3.90	12.49
1700	2.73	9.27	3.07	10.45	3.44	11.71	3.83	13.02
1800	2.66	9.57	3.00	10.81	3.37	12.15	3.76	13.53
1900	2.59	9.86	2.94	11.17	3.31	12.58	3.70	14.04
2000	2.54	10.14	2.88	11.53	3.25	13.01	3.64	14.55
2200	2.43	10.70	2.78	12.22	3.15	13.85	3.53	15.54
2400	2.34	11.23	2.69	12.89	3.06	14.67	3.44	16.51
2600	2.26	11.75	2.61	13.55	2.97	15.47	3.36	17.46
2800	2.19	12.26	2.53	14.19	2.90	16.25	3.29	18.40
3000	2.12	12.75	2.47	14.81	2.84	17.03	3.22	19.33
3200	2.07	13.22	2.41	15.43	2.78	17.79	3.16	20.24
3400	2.01	13.69	2.36	16.03	2.73	18.54	3.11	21.14
3600	1.96	14.15	2.13	16.62	2.68	19.27	3.06	22.03
3800	1.92	14.59	2.26	17.21	2.63	20.00	3.01	22.91
4000	1.88	15.03	2.22	17.78	2.59	20.72	2.97	23.78

Table D-1 (Continued)

U_0	1.0		1.5		2.0		2.5	
N_g	U	q	U	q	U	q	U	q
4200	1.84	15.46	2.18	18.35	2.55	21.43	2.93	24.64
4400	1.80	15.88	2.15	18.91	2.52	22.14	2.90	25.50
4600	1.77	16.30	2.12	19.46	2.48	22.84	2.86	26.35
4800	1.74	16.71	2.08	20.00	2.45	23.53	2.83	27.19
5000	1.71	17.11	2.05	20.54	2.42	24.21	2.80	28.03
5500	1.65	18.10	1.99	21.87	2.35	25.90	2.74	30.09
6000	1.59	19.05	1.93	23.16	2.30	27.55	2.68	32.12
6500	1.54	19.97	1.88	24.43	2.24	29.18	2.63	34.13
7000	1.49	20.88	1.83	25.67	2.20	30.78	2.58	36.11
7500	1.45	21.76	1.79	26.88	2.16	32.36	2.54	38.06
8000	1.41	22.62	1.76	28.08	2.12	33.92	2.50	40.00
8500	1.38	23.46	1.72	29.26	2.09	35.47		
9000	1.35	24.29	1.69	30.43	2.06	36.99		
9500	1.32	25.10	1.66	31.58	2.03	38.50		
10000	1.29	25.90	1.64	32.72	2.00	40.00		
11000	1.25	27.46	1.59	34.95				
12000	1.21	28.97	1.55	37.14				
13000	1.17	30.45	1.51	39.29				
14000	1.14	31.89	$N_g = 13333$ $U = 1.5$ $q = 40$					
15000	1.11	33.31						
16000	1.08	34.69						
17000	1.06	36.05						
18000	1.04	37.39						
19000	1.02	38.70						
20000	1.00	40.00						

Table D-2 Water supply pipe section designed second flow calculation table [U : (%); q : (L/s)]

U_0	3.0		3.5		4.0		4.5	
N_g	U	q	U	q	U	q	U	q
1	100.00	0.20	100.00	0.20	100.00	0.20	100.00	0.20
2	72.08	0.29	72.39	0.29	72.70	0.29	73.02	0.29
3	59.31	0.36	59.66	0.36	60.02	0.36	60.38	0.36
4	51.66	0.41	52.03	0.42	52.41	0.42	52.80	0.42
5	46.43	0.46	46.82	0.47	47.21	0.47	47.60	0.48
6	42.57	0.51	42.96	0.52	43.35	0.52	43.76	0.53
7	39.56	0.55	39.96	0.56	40.36	0.57	40.76	0.57

Table D-2(Continued)

U_0	3.0		3.5		4.0		4.5	
N_g	U	q	U	q	U	q	U	q
8	37.13	0.59	37.53	0.60	37.94	0.61	38.35	0.61
9	35.12	0.63	35.53	0.64	35.93	0.65	36.35	0.65
10	33.42	0.67	33.83	0.68	34.24	0.68	34.65	0.69
11	31.96	0.70	32.36	0.71	32.77	0.72	33.19	0.73
12	30.68	0.74	31.09	0.75	31.50	0.76	31.92	0.77
13	29.55	0.77	29.96	0.78	30.37	0.79	30.79	0.80
14	28.55	0.80	28.96	0.81	29.37	0.82	29.79	0.83
15	27.64	0.83	28.05	0.84	28.47	0.85	28.89	0.87
16	26.83	0.86	27.24	0.87	27.65	0.88	28.08	0.90
17	26.08	0.89	26.49	0.90	26.91	0.91	27.33	0.93
18	25.40	0.91	25.81	0.93	26.23	0.94	26.65	0.96
19	24.77	0.94	25.19	0.96	25.60	0.97	26.03	0.99
20	24.20	0.97	24.61	0.98	25.03	1.00	25.45	1.02
22	23.16	1.02	23.57	1.04	23.99	1.06	24.41	1.07
24	22.25	1.07	22.66	1.09	23.08	1.11	23.51	1.13
26	21.45	1.12	21.87	1.14	22.29	1.16	22.71	1.18
28	20.74	1.16	21.15	1.18	21.57	1.21	22.00	1.23
30	20.10	1.21	20.51	1.23	20.93	1.26	21.36	1.28
32	19.52	1.25	19.94	1.28	20.36	1.30	20.78	1.33
34	18.99	1.29	19.41	1.32	19.83	1.35	20.25	1.38
36	18.51	1.33	18.93	1.36	19.35	1.39	19.77	1.42
38	18.07	1.37	18.48	1.40	18.90	1.44	19.33	1.47
40	17.66	1.41	18.07	1.45	18.49	1.48	18.92	1.51
42	17.28	1.45	17.69	1.49	18.11	1.52	18.54	1.56
44	16.92	1.49	17.34	1.53	17.76	1.56	18.18	1.60
46	16.59	1.53	17.00	1.56	17.43	1.60	17.85	1.64
48	16.28	1.56	16.69	1.60	17.11	1.64	17.54	1.68
50	15.99	1.60	16.40	1.64	16.82	1.68	17.25	1.73
55	15.33	1.69	15.74	1.73	16.17	1.78	16.59	1.82
60	14.76	1.77	15.17	1.82	15.59	1.87	16.02	1.92
65	14.25	1.85	14.66	1.91	15.08	1.96	15.51	2.02
70	13.80	1.93	14.21	1.99	14.63	2.05	15.06	2.11
75	13.39	2.01	13.81	2.07	14.23	2.13	14.65	2.20
80	13.02	2.08	13.44	2.15	13.86	2.22	14.28	2.29
85	12.69	2.16	13.10	2.23	13.52	2.30	13.95	2.37

Table D-2(Continued)

U_0	3.0		3.5		4.0		4.5	
N_g	U	q	U	q	U	q	U	q
90	12.38	2.23	12.80	2.30	13.22	2.38	13.64	2.46
95	12.10	2.30	12.52	2.38	12.94	2.46	13.36	2.54
100	11.84	2.37	12.26	2.45	12.68	2.54	13.10	2.62
110	11.38	2.50	11.79	2.59	12.21	2.69	12.63	2.78
120	10.97	2.63	11.38	2.73	11.80	2.83	12.23	2.93
130	10.61	2.76	11.02	2.87	11.44	2.98	11.87	3.09
140	10.29	2.88	10.70	3.00	11.12	3.11	11.55	3.23
150	10.00	3.00	10.42	3.12	10.83	3.25	11.26	3.38
160	9.74	3.12	10.16	3.25	10.57	3.38	11.00	3.52
170	9.51	3.23	9.92	3.37	10.34	3.51	10.76	3.66
180	9.29	3.34	9.70	3.49	10.12	3.64	10.54	3.80
190	9.09	3.45	9.50	3.61	9.92	3.77	10.34	3.93
200	8.91	3.56	9.32	3.73	9.74	3.89	10.16	4.06
220	8.57	3.77	8.99	3.95	9.40	4.14	9.83	4.32
240	8.29	3.98	8.70	4.17	9.12	4.38	9.54	4.58
260	8.03	4.18	8.44	4.39	8.86	4.61	9.28	4.83
280	7.81	4.37	8.22	4.60	8.63	4.83	9.06	5.07
300	7.60	4.56	8.01	4.81	8.43	5.06	8.85	5.31
320	7.42	4.75	7.83	5.01	8.24	5.28	8.67	5.55
340	7.25	4.93	7.66	5.21	8.08	5.49	8.50	5.78
360	7.10	5.11	7.51	5.40	7.92	5.70	8.34	6.01
380	6.95	5.29	7.36	5.60	7.78	5.91	8.20	6.23
400	6.82	5.46	7.23	5.79	7.65	6.12	8.07	6.46
420	6.70	5.63	7.11	5.97	7.53	6.32	7.95	6.68
440	6.59	5.80	7.00	6.16	7.41	6.52	7.83	6.89
460	6.48	5.97	6.89	6.34	7.31	6.72	7.73	7.11
480	6.39	6.13	6.79	6.52	7.21	6.92	7.63	7.32
500	6.29	6.29	6.70	6.70	7.12	7.12	7.54	7.54
550	6.08	6.69	6.49	7.14	6.91	7.60	7.32	8.06
600	5.90	7.08	6.31	7.57	6.72	8.07	7.14	8.57
650	5.74	7.46	6.15	7.99	6.56	8.53	6.98	9.07
700	5.59	7.83	6.00	8.40	6.42	8.98	6.83	9.57
750	5.46	8.20	5.87	8.81	6.29	9.43	6.70	10.06
800	5.35	8.56	5.75	9.21	6.17	9.87	6.59	10.54
850	5.24	8.91	5.65	9.60	6.06	10.30	6.48	11.01

Table D-2(Continued)

U_0	3.0		3.5		4.0		4.5	
N_g	U	q	U	q	U	q	U	q
900	5.14	9.26	5.55	9.99	5.96	10.73	6.38	11.48
950	5.05	9.60	5.46	10.37	5.87	11.16	6.29	11.95
1000	4.97	9.94	5.38	10.75	5.79	11.58	6.21	12.41
1100	4.82	10.61	5.23	11.50	5.64	12.41	6.06	13.32
1200	4.69	11.26	5.10	12.23	5.51	13.22	5.93	14.22
1300	4.58	11.90	4.98	12.95	5.39	14.02	5.81	15.11
1400	4.48	12.53	4.88	13.66	5.29	14.81	5.71	15.98
1500	4.38	13.15	4.79	14.36	5.20	15.60	5.61	16.84
1600	4.30	13.76	4.70	15.05	5.11	16.37	5.53	17.70
1700	4.22	14.36	4.63	15.74	5.04	17.13	5.45	18.54
1800	4.16	14.96	4.56	16.41	4.97	17.89	5.38	19.38
1900	4.09	15.55	4.49	17.08	4.90	18.64	5.32	20.21
2000	4.03	16.13	4.44	17.74	4.85	19.38	5.26	21.04
2200	3.93	17.28	4.33	19.05	4.74	20.85	5.15	22.67
2400	3.83	18.41	4.24	20.34	4.65	22.30	5.06	24.29
2600	3.75	19.52	4.16	21.61	4.56	23.73	4.98	25.88
2800	3.68	20.61	4.08	22.86	4.49	25.15	4.90	27.46
3000	3.62	21.69	4.02	24.10	4.42	26.55	4.84	29.02
3200	3.56	22.76	3.96	25.33	4.36	27.94	4.78	30.58
3400	3.50	23.81	3.90	26.54	4.31	29.31	4.72	32.12
3600	3.45	24.86	3.85	27.75	4.26	30.68	4.67	33.64
3800	3.41	25.90	3.81	28.94	4.22	32.03	4.63	35.16
4000	3.37	26.92	3.77	30.13	4.17	33.38	4.58	36.67
4200	3.33	27.94	3.73	31.30	4.13	34.72	4.54	38.17
4400	3.29	28.95	3.69	32.47	4.10	36.05	4.51	39.67
4600	3.26	29.96	3.66	33.64	4.06	37.37	$N_g = 4444$ $U = 4.5\%$ $q = 40.00$	
4800	3.22	30.95	3.62	34.79	4.03	38.69		
5000	3.19	31.95	3.59	35.94	4.00	40.00		
5500	3.13	34.40	3.53	38.79				
6000	3.07	36.82	$N_g = 5714$ $U = 3.5$ $q = 40.00$					
6500	3.02	39.21						
6667	3.00	40.00						

Table D-3 Water supply pipe section designed second flow calculation table [U : (%); q : (L/s)]

U_0	5.0		6.0		7.0		8.0	
N_g	U	q	U	q	U	q	U	q
1	100.00	0.20	100.00	0.20	100.00	0.20	100.00	0.20
2	73.33	0.29	73.98	0.30	74.64	0.30	75.30	0.30
3	60.75	0.36	61.49	0.37	62.24	0.37	63.00	0.38
4	53.18	0.43	53.97	0.43	54.76	0.44	55.56	0.44
5	48.00	0.48	48.80	0.49	49.62	0.50	50.45	0.50
6	44.16	0.53	44.98	0.54	45.81	0.55	46.65	0.56
7	41.17	0.58	42.01	0.59	42.85	0.60	43.70	0.61
8	38.76	0.62	39.60	0.63	40.45	0.65	41.31	0.66
9	36.76	0.66	37.61	0.68	38.46	0.69	39.33	0.71
10	35.07	0.70	35.92	0.72	36.78	0.74	37.65	0.75
11	33.61	0.74	34.46	0.76	35.33	0.78	36.20	0.80
12	32.34	0.78	33.19	0.80	34.06	0.82	34.93	0.84
13	31.22	0.81	32.07	0.83	32.94	0.86	33.82	0.88
14	30.22	0.85	31.07	0.87	31.94	0.89	32.82	0.92
15	29.32	0.88	30.18	0.91	31.05	0.93	31.93	0.96
16	28.50	0.91	29.36	0.94	30.23	0.97	31.12	1.00
17	27.76	0.94	28.62	0.97	29.50	1.00	30.86	1.03
18	27.08	0.97	27.94	1.01	28.82	1.04	29.70	1.07
19	26.45	1.01	27.32	1.04	28.19	1.07	29.08	1.10
20	25.88	1.04	26.74	1.07	27.62	1.10	28.50	1.14
22	24.84	1.09	25.71	1.13	26.58	1.17	27.47	1.21
24	23.94	1.15	24.80	1.19	25.68	1.23	26.57	1.28
26	23.14	1.20	24.01	1.25	24.98	1.29	25.77	1.34
28	22.43	1.26	23.30	1.30	24.18	1.35	25.06	1.40
30	21.79	2.31	22.66	1.36	23.54	1.41	24.43	1.47
32	21.21	1.36	22.08	1.41	22.96	1.47	23.85	1.53
34	20.68	1.41	21.55	1.47	22.43	1.53	23.32	1.59
36	20.20	1.45	21.07	1.52	21.95	1.58	22.84	1.64
38	19.76	1.50	20.63	1.57	21.51	1.63	22.40	1.70
40	19.35	1.55	20.22	1.62	21.10	1.69	21.99	1.76
42	18.97	1.59	19.84	1.67	20.72	1.74	21.61	1.82
44	18.61	1.64	19.48	1.71	20.36	1.79	21.25	1.87
46	18.28	1.68	19.15	1.76	20.03	1.84	20.92	1.92
48	17.97	1.73	18.84	1.81	19.72	1.89	20.61	1.98
50	17.68	1.77	18.55	1.86	19.43	1.94	20.32	2.03

Table D-3(Continued)

U_0	5.0		6.0		7.0		8.0	
N_g	U	q	U	q	U	q	U	q
55	17.02	1.87	17.89	1.97	18.77	2.07	19.66	2.16
60	16.45	1.97	17.32	2.08	18.20	2.18	19.08	2.29
65	15.94	2.07	16.81	2.19	17.69	2.30	18.58	2.42
70	15.49	2.17	16.36	2.29	17.24	2.41	18.13	2.54
75	15.08	2.26	15.95	2.39	16.83	2.52	17.72	2.66
80	14.71	2.35	15.58	2.49	16.46	2.63	17.35	2.78
85	14.38	2.44	15.25	2.59	16.13	2.74	17.02	2.89
90	14.07	2.53	14.94	2.69	15.82	2.85	16.71	3.01
95	13.79	2.62	14.66	2.79	15.54	2.95	16.43	3.12
100	13.53	2.71	14.40	2.88	15.28	3.06	16.17	3.23
110	13.06	2.87	13.93	3.06	14.81	3.26	15.70	3.45
120	12.66	3.04	13.52	3.25	14.40	3.46	15.29	3.67
130	12.30	3.20	13.16	3.42	14.04	3.65	14.93	3.88
140	11.97	3.35	12.84	3.60	13.72	3.84	14.61	4.09
150	11.69	3.51	12.55	3.77	13.43	4.03	14.32	4.30
160	11.43	3.66	12.29	3.93	13.17	4.21	14.06	4.50
170	11.19	3.80	12.05	4.10	12.93	4.40	13.82	4.70
180	10.97	3.95	11.84	4.26	12.71	4.58	13.60	4.90
190	10.77	4.09	11.64	4.42	12.51	4.75	13.40	5.09
200	10.59	4.23	11.45	4.58	12.33	4.93	13.21	5.28
220	10.25	4.51	11.12	4.89	11.99	5.28	12.88	5.67
240	9.96	4.78	10.83	5.20	11.70	5.62	12.59	6.04
260	9.71	5.05	10.57	5.50	11.45	5.95	12.33	6.41
280	9.48	5.31	10.34	5.79	11.22	6.28	12.10	6.78
300	9.28	5.57	10.14	6.08	11.01	6.61	11.89	7.14
320	9.09	5.82	9.95	6.37	10.83	6.93	11.71	7.49
340	8.92	6.07	9.78	6.65	10.66	7.25	11.54	7.84
360	8.77	6.31	9.63	6.93	10.50	7.56	11.38	8.19
380	8.63	6.56	9.49	7.21	10.36	7.87	11.24	8.54
400	8.49	6.80	9.35	7.48	10.23	8.18	11.10	8.88
420	8.37	7.03	9.23	7.76	10.10	8.49	10.98	9.22
440	8.26	7.27	9.12	8.02	9.99	8.79	10.87	9.56
460	8.15	7.50	9.01	8.29	9.88	9.09	10.76	9.90
480	8.05	7.73	8.91	8.56	9.78	9.39	10.66	10.23
500	7.96	7.96	8.82	8.82	9.69	9.69	10.56	10.56

Table D-3(Continued)

U_0	5.0		6.0		7.0		8.0	
N_g	U	q	U	q	U	q	U	q
550	7.75	8.52	8.61	9.47	9.47	10.42	10.35	11.30
600	7.56	9.08	8.42	10.11	9.29	11.56	10.16	12.20
650	7.40	9.62	8.26	10.74	9.12	11.86	10.00	13.00
700	7.26	10.16	8.11	11.36	8.98	12.57	9.85	13.79
750	7.13	10.69	7.98	11.97	8.85	13.27	9.72	14.58
800	7.01	11.21	7.86	12.58	8.73	13.96	9.60	15.36
850	6.90	11.73	7.75	13.18	8.62	14.65	9.49	16.14
900	6.80	12.24	7.66	13.78	8.52	15.34	9.39	16.91
950	6.71	12.75	7.56	14.37	8.43	16.01	9.30	17.67
1000	6.63	13.26	7.48	14.96	8.34	16.69	9.22	18.43
1100	6.48	14.25	7.33	16.12	8.19	18.02	9.06	19.94
1200	6.35	15.23	7.20	17.27	8.06	19.34	8.93	21.43
1300	6.23	16.20	7.08	18.41	7.94	20.65	8.81	22.91
1400	6.13	17.15	6.98	19.53	7.84	21.95	8.71	24.38
1500	6.03	18.10	6.88	20.65	7.74	23.23	8.61	25.84
1600	5.95	19.04	6.80	21.76	7.66	24.51	8.53	27.28
1700	5.87	19.97	6.72	22.85	7.58	25.77	8.45	28.72
1800	5.80	20.89	6.65	23.94	7.51	27.03	8.38	30.15
1900	5.74	21.80	6.59	25.03	7.44	28.29	8.31	31.58
2000	5.68	22.71	6.53	26.10	7.38	29.53	8.25	33.00
2200	5.57	24.51	6.42	28.24	7.27	32.01	8.14	35.81
2400	5.48	26.29	6.32	30.35	7.18	34.46	8.04	38.60
2600	5.39	28.05	6.24	32.45	7.10	36.89	$N_g = 2500$ $U = 8.0$ $q = 40.00$	
2800	5.32	29.80	6.17	34.52	7.02	39.31		
3000	5.25	31.53	6.10	36.59	$N_g = 2857$ $U = 7.0$ $q = 40.00$			
3200	5.19	33.24	6.04	38.64				
3400	5.14	34.95	$N_g = 3333$ $U = 6.0$ $q = 40.00$					
3600	5.09	36.64						
3800	5.04	38.33						
4000	5.00	40.00						

Appendix E Fine drinking water number of taps simultaneously use in the calculated pipe section

E.0.1 Simultaneously use number of 12 taps or less than 12 taps

Number of taps n	1	2	3	4 ~ 8	9 ~ 12
Simultaneously use number m	1	2	3	3	4

E.0.2 Simultaneously use number of more than 12 taps

$\begin{matrix} P \\ m \\ n \end{matrix}$	$P = \alpha q_b / 1800 n q_0$ $\alpha = 0.6 \sim 0.9$; n —total number of drinking water tap; q_b —designed hourly flow (L/h); q_0 —rated flow of drinking water tap (L/s)																		
	0.010	0.015	0.020	0.025	0.030	0.035	0.040	0.045	0.050	0.055	0.060	0.065	0.070	0.075	0.080	0.085	0.090	0.095	0.10
13 ~ 25	2	2	3	3	3	4	4	4	4	5	5	5	5	5	6	6	6	6	6
50	3	3	4	4	5	5	6	6	7	7	7	8	8	9	9	9	10	10	10
75	3	4	5	6	6	7	8	8	9	9	10	10	11	11	12	13	13	14	14
100	4	5	6	7	8	8	9	10	11	11	12	13	13	14	15	16	16	17	18
125	4	6	7	8	9	10	11	12	13	13	14	15	16	17	18	18	19	20	21
150	5	6	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
175	5	7	8	10	11	12	14	15	16	17	18	20	21	22	23	24	25	26	27
200	6	8	9	11	12	14	15	16	18	19	20	22	23	24	25	27	28	29	30
225	6	8	10	12	13	15	16	18	19	21	22	24	25	27	28	29	31	32	34
250	7	9	11	13	14	16	18	19	21	23	24	26	27	29	31	32	34	35	37
275	7	9	12	14	15	17	19	21	23	25	26	28	30	31	33	35	36	38	40
300	8	10	12	14	16	19	21	22	24	26	28	30	32	34	36	37	39	41	43
325	8	11	13	15	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46
350	8	11	14	16	19	21	23	25	28	30	32	34	36	38	40	42	45	47	49
375	9	12	14	17	20	22	24	27	29	32	34	36	38	41	43	45	47	49	52
400	9	12	15	18	21	23	26	28	31	33	36	38	40	43	45	48	50	52	55
425	10	13	16	19	22	24	27	30	32	35	37	40	43	45	48	50	53	55	57

Note: 1 n by interpolation
 2 m after decimal point follow 45 rule.

Explanation of wording in this Code

1 In order to treat different situations according to their individual conditions during the implementation of this code, words denoting the different degrees of strictness of demands are explained as follows:

1) Words denoting a very strict or mandatory requirement:

“Must” is used for affirmation;

“Must not” is used for negation.

2) Words denoting a strict requirement under normal conditions:

“Shall” is used for affirmation;

“Shall not” is used for negation.

3) Words denoting a permission of slight choice or an indication of the most suitable choice when conditions allow:

“Should” or “may” are used for affirmation;

“Should not” is used for negation.

2 “Be in accordance with” or “be in compliance with” are used to indicate that it is necessary to implement items in this code according to other relative standards and stipulations.

中华人民共和国国家标准

建筑给水排水设计规范

Code for design of building water supply and drainage

GB 50015 — 2003

主编部门：上海市建设和管理委员会

批准部门：中华人民共和国建设部

施行日期：2003年9月1日

2003 北 京

中华人民共和国建设部 公 告

第 138 号

建设部关于发布国家标准 《建筑给水排水设计规范》的公告

现批准《建筑给水排水设计规范》为国家标准，编号为GB 50015—2003，自 2003 年 9 月 1 日起实施。其中，第 3.2.1、3.2.3、3.2.4、3.2.5、3.2.6、3.2.9、3.2.10、3.2.14、3.5.8、3.9.1、3.9.3、3.9.4、3.9.9、3.9.12、3.9.14、3.9.22、3.9.24、3.9.27、4.2.6、4.3.5、4.3.6、4.3.13、4.3.19、4.5.9、4.8.4、4.8.8、5.4.5、5.4.20 条为强制性条文，必须严格执行。原《建筑给水排水设计规范》GBJ 15—88 同时废止。

本规范由建设部标准定额研究所组织中国计划出版社出版发行。

中华人民共和国建设部
二〇〇三年四月十五日

前 言

本规范系根据建设部建标〔1998〕94号文《关于印发“一九九八年工程建设国家标准制订、修订计划（第一批）”的通知》，由上海市建设和管理委员会主管，上海现代建筑设计（集团）有限公司主编，中国建筑设计研究院、广东省建筑设计研究院参编，对原国家标准《建筑给水排水设计规范》GBJ 15—88进行全面修订。本规范编制过程中总结了近年来建筑给水排水工程的设计经验，对重大问题开展专题研讨，提出了征求意见稿，在广泛征求全国有关设计、科研、大专院校的专家、学者和设计人员意见的基础上，经编制组认真研究分析编制而成。

本规范修订的主要技术内容有：①补充了居住小区给水排水设计内容。②调整和补充了住宅、公共建筑用水定额。③补充了管道连接防污染措施。④补充了新型管材应用技术。⑤住宅给水秒流量计算采用概率修正公式。⑥统一各种材质管道水力计算公式。⑦补充了水上游乐池水循环处理内容。⑧补充了冷却塔及水循环设计内容。⑨删去了推荐性标准在医院污水、游泳池给水排水等方面已有的细节内容，保留了原则性、安全性及卫生方面的条文。⑩删除了生产工艺给水排水的有关条文。⑪补充了屋面雨水压力流计算参数。⑫调整了集中热水供应设计小时耗热量计算公式的适用范围。⑬删除了自然循环热水管道系统的计算。⑭补充了新型热水机组、加热器的有关应用技术要点和参数。⑮补充了饮用净水管道系统的有关内容。

本规范将来需要进行局部修订时，有关局部修订的信息和条文内容将刊登在《工程建设标准化》杂志上。

本规范中以黑体字标志的条文为强制性条文，必须严格执行。

本规范由建设部负责管理和对强制性条文的解释，上海市建设和管理委员会负责具体管理，上海现代建筑设计（集团）有限公司负责具体技术内容的解释。在使用过程中如有需要修改与补充的建议，请将有关资料寄送上海现代建筑设计（集团）有限公司（上海石门二路258号现代建筑设计大厦国家标准《建筑给水排水设计规范》管理组，邮政编码：200041），以供修订时参考。

本规范主编单位、参编单位和主要起草人：

主编单位：上海现代建筑设计（集团）有限公司

参编单位：中国建筑设计研究院

广东省建筑设计研究院

主要起草人：张 森 刘振印 何冠钦 冯旭东 桑鲁青

目次

1 总则	107
2 术语、符号	108
2.1 术语	108
2.2 符号	113
3 给水	116
3.1 用水定额和水压	116
3.2 水质和防水质污染	120
3.3 系统选择	121
3.4 管材、附件和水表	121
3.5 管道布置和敷设	124
3.6 设计流量和管道水力计算	126
3.7 水塔、水箱、贮水池	130
3.8 增压设备、泵房	131
3.9 游泳池和水上游乐池	133
3.10 冷却塔及循环冷却水	135
3.11 水景	137
4 排水	139
4.1 系统选择	139
4.2 卫生器具及存水弯	139
4.3 管道布置和敷设	140
4.4 排水管道水力计算	142
4.5 管材、附件和检查井	146
4.6 通气管	148
4.7 污水泵和集水池	149
4.8 小型生活污水处理	150
4.9 雨水	153
5 热水及饮水供应	157
5.1 热水用水定额、水温和水质	157
5.2 热水供应系统选择	160
5.3 耗热量、热水量和加热设备供热量的计算	161
5.4 水的加热和贮存	163
5.5 管网计算	167
5.6 管材、附件和管道敷设	169
5.7 饮水供应	170
附录 A 居住小区地下管线（构筑物）间最小净距	172
附录 B 阀门和螺纹管件的摩阻损失的折算补偿长度	172
附录 C 给水管段卫生器具给水当量同时出流概率计算式， α_c 系数取值表	173
附录 D 给水管段设计秒流量计算表	173
附录 E 饮用净水计算管段上同时使用水嘴的数量	183
本规范用词说明	184

1 总 则

1.0.1 为保证建筑给水排水设计质量，使设计符合安全、卫生、适用、经济等基本要求，制订本规范。

1.0.2 本规范适用于居住小区、民用建筑给水排水设计，亦适用于工业建筑生活给水排水和厂房屋面雨水排水设计。

但设计下列工程时，还应按现行的有关专门规范或规定执行：

- 1 湿陷性黄土、多年冻土和胀缩土等地区的建筑物。
- 2 抗震设防烈度超过 9 度的建筑物。
- 3 矿泉水疗、人防建筑。
- 4 工业生产给水排水。
- 5 建筑中水。

1.0.3 建筑给水排水设计，应在满足使用要求的同时还应为施工安装、操作管理、维修检测以及安全保护等提供便利条件。

1.0.4 建筑给水排水工程设计，除执行本规范外，尚应符合国家现行的有关标准、规范的要求。

2 术语、符号

2.1 术 语

2.1.1 生活饮用水 potable water

水质符合生活饮用水卫生标准的用于日常饮用、洗涤的水。

2.1.2 生活杂用水 non-drinking water

用于冲洗便器、汽车，浇洒道路、浇灌绿化，补充空调循环用水的非饮用水。

2.1.3 小时变化系数 hourly variation coefficient

最高日最大时用水量与平均时用水量的比值。

2.1.4 最大时用水量 maximum hourly water consumption

最高日用水时间内，最大一小时的用水量。

2.1.5 回流污染 backflow pollution

1 由于给水管道内负压引起卫生器具或受水容器中的水或液体混合物倒流入生活给水系统的现象。

2 非饮用水或其他液体、混合物进入生活给水管道系统的现象。

2.1.6 空气间隙 air gap

1 给水管道出口或水嘴出口的最低点与用水设备溢流水位间的垂直空间距离。

2 间接排水的设备或容器的排出管口最低点与受水器溢流水位间的垂直空间距离。

2.1.7 溢流边缘 flood-level rim

指由此溢流的容器上边缘。

2.1.8 引入管 service pipe, inlet pipe

将室外给水管引入建筑物或由市政管道引入至小区给水管网的管段。

2.1.9 接户管 building unite pipe

布置在建筑物周围，直接与建筑物引入管和排出管相接的给水排水管道。

2.1.10 入户管（进户管） inlet pipe

住宅内生活给水管道进入住户至水表的管段。

2.1.11 竖向分区 vertical division block

建筑给水系统中，在垂直向分成若干供水区。

2.1.12 并联供水 parallel water supply

建筑物各竖向给水分区有独立增（减）压系统供水的方式。

2.1.13 串联供水 series water supply

建筑物各竖向给水分区，逐区串级增（减）压供水的方式。

2.1.14 明设 exposed installation

室内管道明露布置的方法。

2.1.15 暗设 concealed installation, embedded installation

室内管道布置在墙体管槽、管道井或管沟内，或者由建筑装饰隐蔽的敷设方法。

2.1.16 分水器 manifold

集中控制多支路供水的管道附件。

2.1.17 卡套式连接 compression fitting

由带锁紧螺帽和丝扣管件将管材压紧于管件上的连接方式。

2.1.18 卡环式连接 insert connection

用专用管夹和卡环将管材和管件夹紧的连接方式。

2.1.19 线胀系数 coefficient of line-expansion

温度每增加 1℃时, 管线单位长度的增量。

2.1.20 卫生器具 plumbing fixture, fixture

供水并接受、排出污废水或污物的容器或装置。

2.1.21 卫生器具当量 fixture unit

以某一卫生器具流量(给水流量或排水流量)值为基数, 其他卫生器具的流量(给水流量或排水流量)值与其的比值。

2.1.22 额定流量 rate of flow

卫生器具配水出口在单位时间内流出的规定水量。

2.1.23 设计流量 design flow

给水或排水某种时段的平均流量作为建筑给排水管道系统设计依据。

2.1.24 水头损失 head loss

水通过管渠、设备、构筑物等引起的能耗。

2.1.25 气压给水 pneumatic

由水泵和压力罐以及一些附件组成, 水泵将水压入压力罐, 依靠罐内的压缩空气压力, 自动调节供水流量和保持供水压力的供水方式。

2.1.26 配水点 points of distribution

给水系统中的用水点。

2.1.27 循环周期 circulating period

循环水系统构筑物或输水管道内的有效水容积与单位时间内循环量的比值。

2.1.28 反冲洗 backwash

当滤料层截污到一定程度时, 用较强的水流逆向对滤料进行冲洗。

2.1.29 历年平均不保证时 unassured hour for average year

累计历年不保证总小时数的年平均值。

2.1.30 水质稳定处理 water quality stabilization treatment

为保持循环冷却水中的碳酸钙和二氧化碳的浓度达到平衡状态(既不产生碳酸钙沉淀而结垢, 也不因其溶解而腐蚀), 并抑制微生物生长而采用的水处理工艺。

2.1.31 浓缩倍数 cycle of concentration

循环冷却水的含盐浓度与补充水的含盐浓度的比值。

2.1.32 自灌 self-priming

卧式离心泵的泵顶、立式多级离心泵吸水端第一级(段)泵体置于最低设计启动水位标高以下, 启动时水靠重力充入泵体的引水方式。

2.1.33 水景 waterscape, fountain

人工建造的水体景观。

2.1.34 生活污水 domestic soil

居民日常生活中排泄的粪便污水。

2.1.35 生活废水 domestic wastewater

居民日常生活中排泄的洗涤水。

2.1.36 生活排水 domestic sewage

居民在日常生活中排出的生活污水和生活废水的总称。

2.1.37 排出管 building drain, outlet pipe

从建筑物内至室外检查井的排水横管段。

2.1.38 立管 vertical pipe, riser, stack

呈垂直或与垂线夹角小于 45°的管道。

2.1.39 横管 horizontal pipe

呈水平或与水平线夹角小于 45°的管道。

1 横支管 horizontal branch

连接器具排水管至排水立管的管段。

2 横干管 horizontal main

连接若干根排水立管至排出管的管段。

2.1.40 清扫口 cleanout

装在排水横管上，用于清扫排水管的配件。

2.1.41 检查口 checkhole, checkpipe

带有可开启检查盖的配件，装设在排水立管及较长横管段上，作检查和清通之用。

2.1.42 存水弯 trap, water-sealed joint

在卫生器具内部或器具排水管段上设置的一种内有水封的配件。

2.1.43 水封 water seal

在装置中有一定高度的水柱，防止排水管系统中气体窜入室内。

2.1.44 H 管 H pipe

连接排水立管与通气立管形如 H 的专用配件。

2.1.45 通气管 vent pipe, vent

为使排水系统内空气流通，压力稳定，防止水封破坏而设置的与大气相通的管道。

2.1.46 伸顶通气管 stack vent

排水立管与最上层排水横支管连接处向上垂直延伸至室外通气用的管道。

2.1.47 专用通气立管 specific vent stack

仅与排水立管连接，为排水立管内空气流通而设置的垂直通气管道。

2.1.48 汇合通气管 vent headers

连接数根通气立管或排水立管顶端通气部分，并延伸至室外接通大气的通气管段。

2.1.49 主通气立管 main vent stack

连接环形通气管和排水立管，为排水支管和排水立管内空气流通而设置的垂直管道。

2.1.50 副通气立管 secondary vent stack, assistant vent stack

仅与环形通气管连接，为使排水横支管内空气流通而设置的通气立管。

2.1.51 环形通气管 loop vent

在多个卫生器具的排水横支管上,从最始端卫生器具的下游端接至主通气立管或副通气立管的通气管段。

2.1.52 器具通气管 fixture vent

卫生器具存水弯出口端接至主通气管的管段。

2.1.53 结合通气管 yoke vent, yoke vent pipe

排水立管与通气立管的连接管段。

2.1.54 间接排水 indirect drain

设备或容器的排水管道与排水系统非直接连接,其间留有空气间隙。

2.1.55 埋设深度(覆土深度) buried depth

埋地管道管顶至地表面的垂直距离。

2.1.56 水流偏转角 angle of turning flow

水流原来的流向与其改变后的流向之间的夹角。

2.1.57 充满度 depth ratio

水流在管渠中的充满程度,管道以水深与管径之比值表示,渠道以水深与设计最大水深之比值表示。

2.1.58 隔油池 grease interceptor

分隔、拦集生活废水中油脂物质的小型处理构筑物。

2.1.59 降温池 cooling tank

降低排水温度的小型处理构筑物。

2.1.60 化粪池 septic tank

将生活污水分格沉淀,并对污泥进行厌氧消化的小型处理构筑物。

2.1.61 中水 reclaimed water

各种排水经适当处理后达到规定的水质标准后回用的水。

2.1.62 医院污水 hospital sewage

医院、医疗卫生机构中被病原体污染了的水。

2.1.63 一级处理 primary treatment

又称机械处理。采用机械方法对污水进行初级处理。

2.1.64 二级处理 secondary treatment

由机械处理和生物化学或化学处理组成的污水处理过程。

2.1.65 换气次数 air change

通风系统单位时间内送风或排风体积与室内空间体积之比。

2.1.66 降雨强度 rainfall intensity

单位时间内的降雨量。其计量单位通常以 mm/min (或 L/s·ha) 表示。

2.1.67 重现期 recurrence interval

经一定长的雨量观测资料统计分析,等于或大于某暴雨强度的降雨出现一次的平均间隔时间。其单位通常以年表示。

2.1.68 降雨历时 duration of rainfall

降雨过程中的任意连续时段。其计量单位通常以 min 表示。

2.1.69 地面集水时间 inlet time

雨水从相应汇水面积的最远点地表径流到雨水管渠入口的时间。其计量单位通常以 min 表示。简称集水时间。

2.1.70 管内流行时间 time of flow

雨水在管渠中流行的时间，其计量单位通常以 min 表示。简称流行时间。

2.1.71 汇水面积 catchment area

雨水管渠汇集降雨的面积。其计量单位通常以 m^2 或 ha 表示。

2.1.72 重力流雨水排水系统 gravity storm system

按重力流设计的屋面雨水排水系统。

2.1.73 压力流雨水排水系统 pressure storm system

按压力流设计的屋面雨水排水系统。

2.1.74 雨水口 gulley hole, gutter inlet

将地面雨水导入雨水管渠的带格栅的集水口。

2.1.75 雨落水管 down pipe, leader

敷设在建筑物外墙，用于排除屋面雨水的排水立管。

2.1.76 悬吊管 hanged pipe

悬吊在屋架、楼板和梁下或架空在柱上的雨水横管。

2.1.77 雨水斗 rain strainer

将建筑物屋面的雨水导入雨水立管的装置。

2.1.78 径流系数 runoff coefficient

一定汇水面积的雨水量与降雨量的比值。

2.1.79 集中热水供应系统 central hot water supply system

供给一幢或数幢建筑物所需热水的系统。

2.1.80 局部热水供应系统 local hot water supply system

供给单个或数个配水点所需热水的小型系统。

2.1.81 开式热水供应系统 open system for hot water supply

热水管系与大气相通的热水供应系统。

2.1.82 闭式热水供应系统 closed system for hot water supply

热水管系不与大气相通的热水供应系统。

2.1.83 单管热水供应系统 one-pipeline hot water system

用一根管道供单一温度，用水点不再调节水温的热水系统。

2.1.84 热源 source of heat

用以制取热水的能源。

2.1.85 热媒 heat medium

热传递载体。常为热水、蒸汽、烟气。

2.1.86 废热 waste heat

工业生产过程中的带有热量的废弃物质，如废蒸汽、高温废水（液）、高温烟气等。

2.1.87 设计小时耗热量 design heat consumption of maximum hour

热水供应系统中用水设备、器具最大一小时的耗热量。

2.1.88 同程热水供应系统 reversed return hot water system

供水与回水管路长度基本相等的热水供应系统。

2.1.89 第一循环系统 heat carrier circulation system

集中热水供应系统中,蒸汽锅炉与水加热器或热水锅炉(机组)与热水贮水器之间组成的热媒循环系统。

2.1.90 上行下给式 upfeed system

给水横干管位于配水管网的上部,通过立管向下给水的方式。

2.1.91 下行上给式 downfeed system

给水横干管位于配水管网的下部,通过立管向上给水的方式。

2.1.92 回水管 return pipe

在热水循环管系中仅通过循环流量的管段。

2.1.93 饮用净水 fine drinking water

自来水或符合生活饮用水水质标准的水经深度净化后可直接饮用的水。

2.2 符 号

2.2.1 流量、流速

q_g ——给水流量;

q_o ——卫生器具给水或排水额定流量;

q_p ——排水流量;

q_r ——热水用水定额;

q_{rh} ——设计小时热水量;

q_h ——卫生器具热水的小时用水定额;

q_x ——循环流量;

q_{max} ——最大流量;

q_{bc} ——补充水水量;

q_y ——设计雨水流量;

q_j ——设计降雨强度;

q_f ——冷却塔风吹损失水量;

q_s ——冷却塔渗漏损失水量;

q_z ——冷却塔蒸发损失水量;

q_b ——水泵出流量;

v ——管道内的平均水流速度。

2.2.2 水压、水头损失

R ——水力半径;

I ——水力坡度;

P —— 压力;
 i —— 管道单位长度的水头损失;
 h_p —— 循环流量通过配水管网的水头损失;
 h_x —— 循环流量通过回水管网的水头损失;
 H_{xr} —— 第一循环管的自然压力值;
 H_b —— 水泵扬程。

2.2.3 几何特征

F_{jr} —— 加热面积;
 F_w —— 汇水面积;
 h 、 H —— 高度;
 V_q —— 气压水罐总容积;
 V_{ql} —— 气压水罐水容积;
 V_{q2} —— 气压水罐的调节容积;
 V_r —— 贮热容积;
 V_p —— 膨胀水箱的有效容积;
 V_e —— 膨胀罐的容积;
 V_s —— 热水管道系统内的水容量;
 d_j —— 管道计算内径。

2.2.4 计算系数

k 、 α —— 根据建筑物用途而定的系数;
 b —— 卫生器具同时给水、排水百分数及卫生器具同时使用百分数;
 N_n —— 浓缩倍数;
 n —— 管道粗糙系数;
 K —— 传热系数;
 K_h —— 小时变化系数;
 U —— 卫生器具给水当量的同时出流概率;
 U_o —— 最大用水时卫生器具给水当量平均出流概率;
 α_a —— 安全系数;
 α_b —— 气压水罐工作压力比;
 α_c —— 对应 U_o 的系数;
 β —— 气压水罐的容积系数;
 Ψ —— 径流系数;
 M —— 折减系数;
 η —— 有效贮热容积系数;
 ϵ —— 结垢和热媒分布不均匀影响传热效率的系数;
 C_r —— 热水供应系数的热损失系数;
 C_h —— 海澄-威廉系数。

2.2.5 热量、温度、比重和时间

- Q_g ——设计小时供热量;
 Q_h ——设计小时耗热量;
 Q_z ——制备热水所需的热量;
 Q_s ——配水管道的热损失;
 t ——降雨历时;
 t_1 ——地面集流时间;
 t_2 ——管渠内雨水流行时间;
 T ——持续时间;
 t_r ——热水温度;
 t_l ——冷水温度;
 t_c ——被加热水初温;
 t_z ——被加热水终温;
 Δt_j ——计算温度差;
 t_{mc} ——热媒初温;
 t_{mz} ——热媒终温;
 Δt ——温度差;
 ρ_l ——冷水密度;
 ρ_r ——热水密度;
 ρ_h ——热水回水密度;
 ρ_t ——加热前加热、贮热设备内的水的密度;
 C ——水的比热。

2.2.6 其他

- N_g ——管段的卫生器具给水当量总数;
 N_p ——管段的卫生器具排水当量总数;
 N_o ——同类型卫生器具数;
 m ——用水计算单位数;
 n_q ——水泵启动次数。

3 给 水

3.1 用水定额和水压

3.1.1 居住小区给水设计用水量，应根据下列用水量确定：

- 1 居民生活用水量；
- 2 公共建筑用水量；
- 3 绿化用水量；
- 4 水景、娱乐设施用水量；
- 5 道路、广场用水量；
- 6 公用设施用水量；
- 7 未预见用水量及管网漏失水量；
- 8 消防用水量。

注：消防用水量仅用于校核管网计算，不属正常用水量。

3.1.2 居住小区的居民生活用水量，应按小区人口和表 3.1.9 的住宅最高日生活用水定额经计算确定。

3.1.3 居住小区内的公共建筑用水量，应按其使用性质、规模，采用表 3.1.10 中的用水定额经计算确定。

3.1.4 居住小区绿化浇洒用水定额可按浇洒面积 $1.0 \sim 3.0\text{L}/\text{m}^2 \cdot \text{d}$ 计算。干旱地区可酌情增加；公用游泳池、水上游乐池和水景用水量按3.9.17、3.9.18、3.11.2条的规定确定。

3.1.5 居住小区道路、广场的浇洒用水定额可按浇洒面积 $2.0 \sim 3.0\text{L}/\text{m}^2 \cdot \text{d}$ 计算。

3.1.6 居住小区消防用水量和水压及火灾延续时间，应按现行的《建筑设计防火规范》及《高层民用建筑设计防火规范》确定。

3.1.7 居住小区管网漏失水量和未预见水量之和可按最高日用水量的 $10\% \sim 15\%$ 计。

3.1.8 居住小区内的公用设施用水量，应由该设施的管理部門提供用水量，当无重大公用设施时，不另计用水量。

3.1.9 住宅的最高日生活用水定额及小时变化系数，根据住宅类别、建筑标准、卫生器具完善程度和区域等因素，可按表 3.1.9 确定。

表 3.1.9 住宅最高日生活用水定额及小时变化系数

住宅类别		卫生器具设置标准	用水定额 (L/人·d)	小时变化系数 K_h
普通住宅	I	有大便器、洗涤盆	85 ~ 150	3.0 ~ 2.5
	II	有大便器、洗脸盆、洗涤盆、洗衣机、热水器和沐浴设备	130 ~ 300	2.8 ~ 2.3
	III	有大便器、洗脸盆、洗涤盆、洗衣机、集中热水供应（或家用热水机组）和沐浴设备	180 ~ 320	2.5 ~ 2.0
别墅		有大便器、洗脸盆、洗涤盆、洗衣机、洒水栓，家用热水机组和沐浴设备	200 ~ 350	2.3 ~ 1.8

注：1 当地主管部门对住宅生活用水定额有具体规定时，应按当地规定执行。

2 别墅用水定额中含庭院绿化用水和汽车抹车用水。

3.1.10 集体宿舍、旅馆等公共建筑的生活用水定额及小时变化系数，根据卫生器具完善程度和区域条件，可按表 3.1.10 确定。

表 3.1.10 集体宿舍、旅馆和公共建筑生活用水定额及小时变化系数

序号	建筑物名称	单位	最高日生活用水定额 (L)	使用时数 (h)	小时变化系数 K_h
1	单身职工宿舍、学生宿舍、招待所、培训中心、普通旅馆 设公用盥洗室 设公用盥洗室、淋浴室 设公用盥洗室、淋浴室、洗衣室 设单独卫生间、公用洗衣室	每人每日 每人每日 每人每日 每人每日	50 ~ 100 80 ~ 130 100 ~ 150 120 ~ 200	24	3.0 ~ 2.5
2	宾馆客房 旅客 员工	每床位每日 每人每日	250 ~ 400 80 ~ 100	24	2.5 ~ 2.0
3	医院住院部 设公用盥洗室 设公用盥洗室、淋浴室 设单独卫生间 医务人员 门诊部、诊疗所 疗养院、休养所住房部	每床位每日 每床位每日 每床位每日 每人每班 每病人每次 每床位每日	100 ~ 200 150 ~ 250 250 ~ 400 150 ~ 250 10 ~ 15 200 ~ 300	24 24 24 8 8 ~ 12 24	2.5 ~ 2.0 2.5 ~ 2.0 2.5 ~ 2.0 2.0 ~ 1.5 1.5 ~ 1.2 2.0 ~ 1.5
4	养老院、托老所 全托 日托	每人每日 每人每日	100 ~ 150 50 ~ 80	24 10	2.5 ~ 2.0 2.0
5	幼儿园、托儿所 有住宿 无住宿	每儿童每日 每儿童每日	50 ~ 100 30 ~ 50	24 10	3.0 ~ 2.5 2.0
6	公共浴室 淋浴 浴盆、淋浴 桑拿浴 (淋浴、按摩池)	每顾客每次 每顾客每次 每顾客每次	100 120 ~ 150 150 ~ 200	12 12 12	2.0 ~ 1.5
7	理发室、美容院	每顾客每次	40 ~ 100	12	2.0 ~ 1.5
8	洗衣房	每 kg 干衣	40 ~ 80	8	1.5 ~ 1.2
9	餐饮业 中餐酒楼 快餐店、职工及学生食堂 酒吧、咖啡馆、茶座、卡拉 OK 房	每顾客每次 每顾客每次 每顾客每次	40 ~ 60 20 ~ 25 5 ~ 15	10 ~ 12 12 ~ 16 8 ~ 18	1.5 ~ 1.2 1.5 ~ 1.2 1.5 ~ 1.2
10	商场 员工及顾客	每 m ² 营业厅 面积每日	5 ~ 8	12	1.5 ~ 1.2

续表 3.1.10

序号	建筑物名称	单位	最高日生活用水定额 (L)	使用时数 (h)	小时变化系数 K_h
11	办公楼	每人每班	30~50	8~10	1.5~1.2
12	教学、实验楼 中小学校 高等院校	每学生每日	20~40	8~9	1.5~1.2
		每学生每日	40~50	8~9	1.5~1.2
13	电影院、剧院	每观众每场	3~5	3	1.5~1.2
14	健身中心	每人每次	30~50	8~12	1.5~1.2
15	体育场 (馆) 运动员淋浴 观众	每人每次	30~40	—	3.0~2.0
		每人每场	3	4	1.2
16	会议厅	每座位每次	6~8	4	1.5~1.2
17	客运站旅客、展览中心观众	每人每次	3~6	8~16	1.5~1.2
18	菜市场地面冲洗及保鲜用水	每 m^2 每日	10~20	8~10	2.5~2.0
19	停车库地面冲洗水	每 m^2 每次	2~3	6~8	1.0

注：1 除养老院、托儿所、幼儿园的用水定额中含食堂用水，其他均不含食堂用水。

2 除注明外，均不含员工生活用水，员工用水定额为每人每班 40~60L。

3 医疗建筑用水中已含医疗用水。

4 空调用水应另计。

3.1.11 建筑物室内、外消防用水量、供水延续时间、供水水压等，应根据现行有关消防规范执行。

3.1.12 工业企业建筑，管理人员的生活用水定额可取 30~50L/人·班；车间工人的生活用水定额应根据车间性质确定，一般宜采用 30~50L/人·班；用水时间为 8h，小时变化系数为 1.5~2.5。

工业企业建筑淋浴用水定额，应根据《工业企业设计卫生标准》中的车间的卫生特征分级确定，一般可采用 40~60L/人·次，延续供水时间为 1h。

3.1.13 汽车冲洗用水定额，应根据车辆用途、道路路面等级和沾污程度，以及采用的冲洗方式，可按表 3.1.13 确定。

表 3.1.13 汽车冲洗用水量定额 (L/辆·次)

冲洗方式	软管冲洗	高压水枪冲洗	循环用水冲洗	抹车
轿车	200~300	40~60	20~30	10~15
公共汽车 载重汽车	400~500	80~120	40~60	15~30

3.1.14 卫生器具的给水额定流量、当量、连接管径和最低工作压力应按表 3.1.14 确定。

表 3.1.14 卫生器具的给水额定流量、当量、
连接管公称管径和最低工作压力

序 号	给水配件名称	额定流量 (L/s)	当 量	连接管公 称管径 (mm)	最低工 作压力 (MPa)
1	洗涤盆、拖布盆、盥洗槽				
	单阀水嘴	0.15 ~ 0.20	0.75 ~ 1.00	15	0.050
	单阀水嘴	0.30 ~ 0.40	1.50 ~ 2.00	20	
	混合水嘴	0.15 ~ 0.20(0.14)	0.75 ~ 1.00(0.70)	15	
2	洗脸盆				
	单阀水嘴 混合水嘴	0.15 0.15(0.10)	0.75 0.75(0.50)	15 15	0.050
3	洗手盆				
	感应水嘴 混合水嘴	0.10 0.15(0.10)	0.50 0.75(0.50)	15 15	0.050
4	浴盆				
	单阀水嘴 混合水嘴(含带淋浴转换器)	0.20 0.24(0.20)	1.00 1.20(1.00)	15 15	0.050 0.050 ~ 0.070
5	淋浴器 混合阀	0.15(0.10)	0.75(0.50)	15	0.050 ~ 0.100
6	大便器				
	冲洗水箱浮球阀 延时自闭式冲洗阀	0.10 1.20	0.50 6.00	15 25	0.020 0.100 ~ 0.150
7	小便器				
	手动或自动自闭式冲洗阀 自动冲洗水箱进水阀	0.10 0.10	0.50 0.50	15 15	0.050 0.020
8	小便槽穿孔冲洗管(每 m 长)	0.05	0.25	15 ~ 20	0.015
9	净身盆冲洗水嘴	0.10(0.07)	0.50(0.35)	15	0.050
10	医院倒便器	0.20	1.00	15	0.050
11	实验室化验水嘴(鹅颈)				
	单联	0.07	0.35	15	0.020
	双联	0.15	0.75	15	0.020
	三联	0.20	1.00	15	0.020
12	饮水器喷嘴	0.05	0.25	15	0.050
13	洒水栓				
		0.40 0.70	2.00 3.50	20 25	0.050 ~ 0.100 0.050 ~ 0.100
14	室内地面冲洗水嘴	0.20	1.00	15	0.050
15	家用洗衣机水嘴	0.20	1.00	15	0.050

注：1 表中括弧内的数值系在有热水供应时，单独计算冷水或热水时使用。

2 当浴盆上附设淋浴器时，或混合水嘴有淋浴器转换开关时，其额定流量和当量只计水嘴，不计淋浴器。但水压应按淋浴器计。

3 家用燃气热水器，所需水压按产品要求和热水供应系统最不利配水点所需工作压力确定。

4 绿地的自动喷灌应按产品要求设计。

3.2 水质和防水质污染

3.2.1 生活给水系统的水质，应符合现行的国家标准《生活饮用水卫生标准》的要求。

3.2.2 生活杂用水系统的水质，应符合现行行业标准《生活杂用水水质标准》的要求。

3.2.3 城市给水管道严禁与自备水源的供水管道直接连接。

3.2.4 生活饮用水不得因管道产生虹吸回流而受污染，生活饮用水管道的配水件出水口应符合下列规定：

1 出水口不得被任何液体或杂质所淹没；

2 出水口高出承接用水容器溢流边缘的最小空气间隙，不得小于出水口直径的2.5倍；

3 特殊器具不能设置最小空气间隙时，应设置管道倒流防止器或采取其他有效的隔断措施。

3.2.5 从给水管道上直接接出下列用水管道时，应在这些用水管道上设置管道倒流防止器或其他有效的防止倒流污染的装置：

1 单独接出消防用水管道时，在消防用水管道的起端；

注：不含室外给水管道上接出的室外消火栓。

2 从城市给水管道上直接吸水的水泵，其吸水管起端；

3 当游泳池、水上游乐池、按摩池、水景观赏池、循环冷却水集水池等的充水或补水管道出口与溢流水位之间的空气间隙小于出口管径2.5倍时，在充（补）水管上；

4 由城市给水管直接向锅炉、热水机组、水加热器、气压水罐等有压容器或密闭容器注水的注水管上；

5 垃圾处理站、动物养殖场（含动物园的饲养展览区）的冲洗管道及动物饮水管道的起端；

6 绿地等自动喷灌系统，当喷头为地下式或自动升降式时，其管道起端；

7 从城市给水环网的不同管段接出引入管向居住小区供水，且小区供水管与城市给水管形成环状管网时，其引入管上（一般在总水表后）。

3.2.6 严禁生活饮用水管道与大便器（槽）直接连接。

3.2.7 生活饮用水管道应避开毒物污染区，当条件限制不能避开时，应采取防护措施。

3.2.8 生活饮用水池（箱）应与其他用水的水池（箱）分开设置。

3.2.9 埋地式生活饮用水贮水池周围10m以内，不得有化粪池、污水处理构筑物、渗水井、垃圾堆放点等污染源；周围2m以内不得有污水管和污染物。当达不到此要求时，应采取防污染的措施。

3.2.10 建筑物内的生活饮用水水池（箱）体，应采用独立结构形式，不得利用建筑物的本体结构作为水池（箱）的壁板、底板及顶盖。

生活饮用水水池（箱）与其他用水水池（箱）并列设置时，应有各自独立的分隔墙，不得共用一幅分隔墙，隔墙与隔墙之间应有排水措施。

3.2.11 建筑物内的生活饮用水水池（箱）宜设在专用房间内，其上方的房间不应有厕所、浴室、盥洗室、厨房、污水处理间等。

3.2.12 生活饮用水水池（箱）的构造和配管，应符合下列规定：

1 人孔、通气管、溢流管应有防止昆虫爬入水池（箱）的措施。

2 进水管应在水池（箱）的溢流水位以上接入，当溢流水位确定有困难时，进水管口的最低点高出溢流边缘的高度等于进水管管径，但最小不应小于 25mm，最大可不大于 150mm。

当进水管口为淹没出流时，管顶应钻孔，孔径不宜小于管径的 1/5。孔上宜装设同径的吸气阀或其他能破坏管内产生真空的装置。

注：不存在虹吸倒流的低位水池，其进水管不受本款限制，但进水管仍宜从最高水面以上进入水池。

3 进出水管布置不得产生水流短路，必要时应设导流装置。

4 不得接纳消防管道试压水、泄压水等回流水或溢流水。

5 泄空管和溢流管的出口，不得直接与排水构筑物或排水管道相连接，应采取间接排水的方式。

6 水池（箱）材质、衬砌材料和内壁涂料，不得影响水质。

3.2.13 当生活饮用水水池（箱）内的贮水，48h 内不能得到更新时，应设置水消毒处理装置。

3.2.14 在非饮用水管道上接出水嘴或取水短管时，应采取防止误饮误用的措施。

3.3 系统选择

3.3.1 居住小区的室外给水系统，其水量应满足居住小区内全部用水的要求。

居住小区的室外给水系统，应尽量利用城市市政给水管网的水压直接供水。当市政给水管网的水压、水量不足时，应设置贮水调节和加压装置。

3.3.2 居住小区的加压给水系统，应根据小区的规模、建筑高度和建筑物的分布等因素确定加压站的数量、规模和水压。

3.3.3 建筑物内不同使用性质或计费的给水系统，应在引入管后分成各自独立的给水管网。

3.3.4 卫生器具给水配件承受的最大工作压力，不得大于 0.6MPa。

3.3.5 高层建筑生活给水系统应竖向分区，竖向分区应符合下列要求：

1 各分区最低卫生器具配水点处的静水压不宜大于 0.45MPa，特殊情况下不宜大于 0.55MPa；

2 水压大于 0.35MPa 的入户管（或配水横管），宜设减压或调压设施；

3 各分区最不利配水点的水压，应满足用水水压要求。

3.3.6 建筑高度不超过 100m 的建筑的生活给水系统，宜采用垂直分区并联供水或分区减压的供水方式。建筑高度超过 100m 的建筑，宜采用垂直串联供水方式。

3.4 管材、附件和水表

3.4.1 给水系统采用的管材和管件，应符合现行产品标准的要求。管道和管件的工作压力不得大于产品标准标称的允许工作压力。

3.4.2 埋地给水管道采用的管材，应具有耐腐蚀和能承受相应地面荷载的能力。可采用塑料给水管、有衬里的铸铁给水管、经可靠防腐处理的钢管。

3.4.3 室内的给水管道，应选用耐腐蚀和安装连接方便可靠的管材，可采用塑料给水管、

塑料和金属复合管、铜管、不锈钢管及经可靠防腐处理的钢管。

3.4.4 给水管道上使用的各类阀门的材质，应耐腐蚀和耐压。根据管径大小和所承受压力的等级及使用温度，可采用全铜、全不锈钢、铁壳铜芯和全塑阀门等。

3.4.5 给水管道的下列部位应设置阀门：

- 1 居住小区给水管道从市政给水管道的引入管段上。
- 2 居住小区室外环状管网的节点处，应按分隔要求设置。环状管段过长时，宜设置分段阀门。
- 3 从居住小区给水干管上接出的支管起端或接户管起端。
- 4 入户管、水表前和各分支立管。
- 5 室内给水管道向住户、公用卫生间等接出的配水管起端；配水支管上配水点在3个及3个以上时应设置。
- 6 水池、水箱、加压泵房、加热器、减压阀、管道倒流防止器等应按安装要求配置。

3.4.6 给水管道上使用的阀门，应根据使用要求按下列原则选型：

- 1 需调节流量、水压时，宜采用调节阀、截止阀；
- 2 要求水流阻力小的部位（如水泵吸水管上），宜采用闸板阀；
- 3 安装空间小的场所，宜采用蝶阀、球阀；
- 4 水流需双向流动的管段上，不得使用截止阀；
- 5 口径较大的水泵，出水管上宜采用多功能阀。

3.4.7 给水管道的下列管段上应设置止回阀：

- 1 引入管上；
- 2 密闭的水加热器或用水设备的进水管上；
- 3 水泵出水管上；
- 4 进出水管合用一条管道的水箱、水塔、高地水池的出水管段上。

注：装有管道倒流防止器的管段，不需再装止回阀。

3.4.8 止回阀的阀型选择，应根据止回阀的安装部位、阀前水压、关闭后的密闭性能要求和关闭时引发的水锤大小等因素确定，应符合下列要求：

- 1 阀前水压小的部位，宜选用旋启式、球式和梭式止回阀。
- 2 关闭后密闭性能要求严密的部位，宜选用有关闭弹簧的止回阀。
- 3 要求削弱关闭水锤的部位，宜选用速闭消声止回阀或有阻尼装置的缓闭止回阀。
- 4 止回阀的阀瓣或阀芯，应能在重力或弹簧力作用下自行关闭。

3.4.9 给水管网的压力高于配水点允许的最高使用压力时，应设置减压阀，减压阀的配置应符合下列要求：

- 1 比例式减压阀的减压比不宜大于3:1；可调式减压阀的阀前与阀后的最大压差不应大于0.4MPa，要求环境安静的场所不应大于0.3MPa。
- 2 阀后配水件处的最大压力应按减压阀失效情况下进行校核，其压力不应大于配水件的产品标准规定的水压试验压力。

注：1 当减压阀串联使用时，按其中一个失效情况下，计算阀后最高压力。

2 配水件的试验压力一般按其工作压力的1.5倍计。

3 减压阀前的水压宜保持稳定，阀前的管道不宜兼作配水管。

4 阀后压力允许波动时,宜采用比例式减压阀;阀后压力要求稳定时,宜采用可调式减压阀。

5 供水保证率要求高,停水会引起重大经济损失的给水管道上设置减压阀时,宜采用两个减压阀,并联设置,一用一备工作,但不得设置旁通管。

3.4.10 减压阀的设置应符合下列要求:

- 1 减压阀的公称直径应与管道管径相一致。
- 2 减压阀前应设阀门和过滤器;需拆卸阀体才能检修的减压阀后,应设管道伸缩器;检修时阀后水会倒流时,阀后应设阀门。
- 3 减压阀节点处的前后应装设压力表。
- 4 比例式减压阀宜垂直安装,可调式减压阀宜水平安装。
- 5 设置减压阀的部位,应便于管道过滤器的排污和减压阀的检修,地面宜有排水设施。

3.4.11 当给水管网存在短时超压工况,且短时超压会引起使用不安全时,应设置泄压阀,泄压阀的设置应符合下列要求:

- 1 泄压阀用于管网泄压,阀前应设置阀门。
- 2 泄压阀的泄水口,应连接管道,泄压水宜排入非生活用水水池,当直接排放时,应有消能措施。

3.4.12 安全阀阀前不得设置阀门,泄压口应连接管道将泄压水(汽)引至安全地点排放。

3.4.13 给水管道的下列部位应设置排气装置:

- 1 间歇性使用的给水管网,其管网末端和最高点应设置自动排气阀。
- 2 给水管网有明显起伏积聚空气的管段,宜在该段的峰点设自动排气阀或手动阀门排气。
- 3 气压给水装置,当采用自动补气式气压水罐时,其配水管网的最高点应设自动排气阀。

3.4.14 给水系统的调节水池(箱),除进水能自动控制切断进水者外,其进水管上应设自动水位控制阀,水位控制阀的公称直径应与进水管管径一致。

3.4.15 给水管道的下列部位应设置管道过滤器:

- 1 减压阀、自动水位控制阀,温度调节阀等阀件前应设置。
- 2 水加热器的进水管上,换热装置的循环冷却水进水管上宜设置。
- 3 水泵吸水管上宜设置管道过滤器。
- 4 进水总表前应设置;住宅进户水表前宜设置。

注:过滤器的滤网应采用耐腐蚀材料,滤网网孔尺寸应按使用要求确定。

3.4.16 建筑物的引入管,住宅的入户管及公用建筑物内需计量水量的水管上均应设置水表。

3.4.17 住宅的分户水表宜相对集中读数,且宜设置于户外;对设在户内的水表,宜采用远传水表或IC卡水表等智能化水表。

3.4.18 水表口径的确定应符合以下规定:

- 1 水表口径宜与给水管道接口管径一致;

- 2 用水量均匀的生活给水系统的水表应以给水设计流量选定水表的常用流量；
- 3 用水量不均匀的生活给水系统的水表应以设计流量选定水表的过载流量；
- 4 在消防时除生活用水外尚需通过消防流量的水表，应以生活用水的设计流量叠加消防流量进行校核，校核流量不应大于水表的过载流量。

3.4.19 水表应装设在观察方便、不冻结、不被任何液体及杂质所淹没和不易受损坏的地方。

注：各种有累计水量功能的流量计，均可替代水表。

3.4.20 给水加压系统，应根据水泵扬程、管道走向、环境噪音要求等因素，设置水锤消除装置。

3.4.21 隔音防噪要求严格的场所，给水管道的支架应采用隔振支架；配水管起端宜设置水锤吸纳装置；配水支管与卫生器具配水件的连接宜采用软管连接。

3.5 管道布置和敷设

3.5.1 居住小区的室外给水管网，宜布置成环状网，或与市政给水管连接成环状网。

环状给水管网与市政给水管的连接管不宜少于两条，当其中一条发生故障时，其余的连接管应能通过不小于 70% 的流量。

3.5.2 居住小区的室外给水管道，应沿区内道路平行于建筑物敷设，宜敷设在人行道、慢车道或草地下；管道外壁距建筑物外墙的净距不宜小于 1m，且不得影响建筑物的基础。

居住小区的室外给水管道与其他地下管线及乔木之间的最小净距，应符合本规范附录 A 的规定。

3.5.3 室外给水管道的覆土深度，应根据土壤冰冻深度、车辆荷载、管道材质及管道交叉等因素确定。管顶最小覆土深度不得小于土壤冰冻线以下 0.15m，行车道下的管线覆土深度不宜小于 0.7m。

3.5.4 室外给水管道上的阀门，宜设置阀门井或阀门套筒。

3.5.5 敷设在室外综合管廊（沟）内的给水管道，宜在热水、热力管道下方，冷冻管和排水管的上方。给水管道与各种管道之间的净距，应满足安装操作的需要，且不宜小于 0.3m。

室内冷、热水管上、下平行敷设时，冷水管应在热水管下方；垂直平行敷设时，冷水管应在热水管右侧。

生活给水管道不宜与输送易燃、可燃或有害的液体或气体的管道同管廊（沟）敷设。

3.5.6 室内生活给水管道宜布置成枝状管网，单向供水。

3.5.7 室内给水管道不应穿越变配电房、电梯机房、通信机房、大中型计算机房、计算机网络中心、音像库房等遇水会损坏设备和引发事故的房间，并应避免在生产设备上方通过。

室内给水管道的布置，不得妨碍生产操作、交通运输和建筑物的使用。

3.5.8 室内给水管道不得布置在遇水会引起燃烧、爆炸的原料、产品和设备的上面。

3.5.9 埋地敷设的给水管道应避免布置在可能受重物压坏处。管道不得穿越生产设备基础，在特殊情况下必须穿越时，应采取有效的保护措施。

3.5.10 给水管道不得敷设在烟道、风道、电梯井内、排水沟内。给水管道不宜穿越橱窗、壁柜。给水管道不得穿过大便槽和小便槽，且立管离大、小便槽端部不得小于0.5m。

3.5.11 给水管道不宜穿越伸缩缝、沉降缝、变形缝。如必须穿越时，应设置补偿管道伸缩和剪切变形的装置。

3.5.12 塑料给水管道在室内宜暗设。明设时立管应布置在不易受撞击处，如不能避免时，应在管外加保护措施。

3.5.13 塑料给水管道不得布置在灶台上边缘；明设的塑料给水立管距灶台边缘不得小于0.4m，距燃气热水器边缘不宜小于0.2m。达不到此要求时，应有保护措施。

塑料给水管道不得与水加热器或热水炉直接连接，应有不小于0.4m的金属管段过渡。

3.5.14 室内给水管道上的各种阀门，宜装设在便于检修和便于操作的位置。

3.5.15 建筑物内埋地敷设的生活给水管与排水管之间的最小净距，平行埋设时不应小于0.5m；交叉埋设时不应小于0.15m，且给水管应在排水管的上面。

3.5.16 给水管道的伸缩补偿装置，应按直线长度、管材的线胀系数、环境温度和管内水温的变化、管道节点的允许位移量等因素经计算确定。应尽量利用管道自身的折角补偿温度变形。

3.5.17 当给水管道结露会影响环境，引起装饰、物品等受损害时，给水管道应做防结露保冷层，防结露保冷层的计算和构造，按现行的《设备及管道保冷技术通则》执行。

3.5.18 给水管道暗设时，应符合下列要求：

- 1 不得直接敷设在建筑物结构层内；
- 2 干管和立管应敷设在吊顶、管井、管窿内，支管宜敷设在楼（地）面的找平层内或沿墙敷设在管槽内；
- 3 敷设在找平层或管槽内的给水支管的外径不宜大于25mm；
- 4 敷设在找平层或管槽内的给水管管材宜采用塑料、金属与塑料复合管材或耐腐蚀的金属管材；
- 5 敷设在找平层或管槽内的管材，如采用卡套式或卡环式接口连接的管材，宜采用分水器向各卫生器具配水，中途不得有连接配件，两端接口应明露。地面宜有管道位置的临时标识。

3.5.19 管道井的尺寸，应根据管道数量、管径大小、排列方式、维修条件，结合建筑平面和结构形式等合理确定。需进入维修管道的管井，其维修人员的工作通道净宽度不宜小于0.6m。管道井应每层设外开检修门。

管道井的井壁和检修门的耐火极限及管道井的竖向防火隔断应符合消防规范的规定。

3.5.20 给水管道应避免穿越人防地下室，必须穿越时应按人防工程要求设置防爆阀门。

3.5.21 需要泄空的给水管道，其横管宜设有0.002~0.005的坡度坡向泄水装置。

3.5.22 给水管道穿越下列部位或接管时，应设置防水套管：

- 1 穿越地下室或地下构筑物的外墙处；
- 2 穿越屋面处；

注：有可靠的防水措施时，可不设套管。

3 穿越钢筋混凝土水池（箱）的壁板或底板连接管道时。

3.5.23 明设的给水立管穿越楼板时，应采取防水措施。

3.5.24 在室外明设的给水管道，应避免受阳光直接照射，塑料给水管还应有有效保护措施；在结冻地区应做保温层，保温层的外壳，应密封防渗。

3.5.25 敷设在有可能结冻的房间、地下室及管井、管沟等地方的给水管道应有防冻措施。

3.6 设计流量和管道水力计算

3.6.1 居住小区的室外给水管道的的设计流量，应按下列规定确定：

1 当居住小区的规模在 3000 人及以下，且室外给水管网为枝状管网时，其住宅及小区内配套的文体、餐饮娱乐、商铺及市场等设施的生活用水设计流量应按本规范 3.6.3、3.6.4 和 3.6.5 条的规定计算节点流量和管段流量。

2 当居住小区的规模在 3000 人以上，室外给水管网为环状管网，并符合本规范 3.5.1 条的规定时，其住宅应按本规范 3.1.9 条的规定计算最大用水时平均秒流量为节点流量。小区内配套的文体、餐饮娱乐、商铺及市场等设施生活用水设计流量，应按本规范 3.1.10 条计算最大用水小时平均秒流量为节点流量。

3 小区内配套的文教、医疗保健、社区管理等设施，以及绿化和景观用水、道路及广场洒水、公共设施用水等，均以平均用水小时平均秒流量计算节点流量。

注：1 未预计水量和管网漏失量不计入管网节点流量，仅在计算小区管网与城市管网连接的引入管时，考虑预留此余量。

2 凡不属于小区配套的公共建筑均应另计。

3.6.2 居住小区的室外给水管道，不论小区规模及管网形状，均应按 3.6.1 条第 2 款规定计算节点流量，再叠加区内一次火灾的最大消防流量（有消防贮水和专用消防管道供水的部分应扣除），对管道进行水力计算校核，管道末梢的室外消火栓从地面算起的水压，不得低于 0.1MPa。

设有室外消火栓的室外给水管道，管径不得小于 100mm。

3.6.3 建筑物的给水引入管的设计流量，应符合下列要求：

1 当建筑物内的生活用水全部由室外管网直接供水时，应取建筑物内的生活用水设计秒流量。

2 当建筑物内的生活用水全部自行加压供给时，引入管的设计流量应为贮水调节池的设计补水量。设计补水量不宜大于建筑物最高日最大时生活用水量，且不得小于建筑物最高日平均时生活用水量。

3 当建筑物内的生活用水既有室外管网直接供水，又有自行加压供水时，应按本条第 1、2 款计算设计流量后，将两者叠加作为引入管的设计流量。

3.6.4 住宅建筑的生活给水管道的的设计秒流量，应按下列步骤和方法计算：

1 根据住宅配置的卫生器具给水当量、使用人数、用水定额、使用时数及小时变化系数，按 3.6.4-1 式计算出最大用水时卫生器具给水当量平均出流概率：

$$U_o = \frac{q_o m K_h}{0.2 \cdot N_g \cdot T \cdot 3600} (\%) \quad (3.6.4-1)$$

式中 U_0 ——生活给水管道的最大用水时卫生器具给水当量平均出流概率 (%)；

q_0 ——最高用水日的用水定额，按表 3.1.9 取用；

m ——每户用水人数；

K_h ——小时变化系数，按表 3.1.9 取用；

N_g ——每户设置的卫生器具给水当量数；

T ——用水时数 (h)；

0.2——一个卫生器具给水当量的额定流量 (L/s)。

2 根据计算管段上的卫生器具给水当量总数，按 3.6.4-2 式计算得出该管段的卫生器具给水当量的同时出流概率：

$$U = \frac{1 + \alpha_c (N_g - 1)^{0.49}}{\sqrt{N_g}} (\%) \quad (3.6.4-2)$$

式中 U ——计算管段的卫生器具给水当量同时出流概率 (%)；

α_c ——对应于不同 U_0 的系数，查附录 C 中表 C；

N_g ——计算管段的卫生器具给水当量总数。

3 根据计算管段上的卫生器具给水当量同时出流概率，按 3.6.4-3 式计算得计算管段的设计秒流量：

$$q_g = 0.2 \cdot U \cdot N_g \text{ (L/s)} \quad (3.6.4-3)$$

式中 q_g ——计算管段的设计秒流量 (L/s)。

注：1 为了计算快速、方便，在计算出 U_0 后，即可根据计算管段的 N_g 值从附录 D 的计算表中直接查得给水设计秒流量。该表可用内插法。

2 当计算管段的卫生器具给水当量总数超过表 D 中的最大值时，其流量应取最大用水时平均秒流量，即 $q_g = 0.2 U_0 N_g$ 。

4 有两条或两条以上具有不同最大用水时卫生器具给水当量平均出流概率的给水支管的给水干管，该管段的最大时卫生器具给水当量平均出流概率按 3.6.4-4 式计算：

$$\overline{U}_0 = \frac{\sum U_{0i} N_{gi}}{\sum N_{gi}} \quad (3.6.4-4)$$

式中 $\overline{U}_0$ ——给水干管的卫生器具给水当量平均出流概率；

U_{0i} ——支管的最大用水时卫生器具给水当量平均出流概率；

N_{gi} ——相应支管的卫生器具给水当量总数。

3.6.5 集体宿舍、旅馆、宾馆、医院、疗养院、幼儿园、养老院、办公楼、商场、客运站、会展中心、中小学教学楼、公共厕所等建筑的生活给水设计秒流量，应按下式计算：

$$q_g = 0.2 \alpha \sqrt{N_g} \quad (3.6.5)$$

式中 q_g ——计算管段的给水设计秒流量 (L/s)；

N_g ——计算管段的卫生器具给水当量总数；

α ——根据建筑物用途而定的系数，应按表 3.6.5 采用。

注：1 如计算值小于该管段上一个最大卫生器具给水额定流量时，应采用一个最大的卫生器具给水额

定流量作为设计秒流量。

- 2 如计算值大于该管段上按卫生器具给水额定流量累加所得流量值时,应按卫生器具给水额定流量累加所得流量值采用。
- 3 有大便器延时自闭冲洗阀的给水管段,大便器延时自闭冲洗阀的给水当量均以 0.5 计,计算得到的 q_g 附加 1.10L/s 的流量后,为该管段的给水设计秒流量。
- 4 综合楼建筑的 α 值应按加权平均法计算。

3.6.6 工业企业的生活间、公共浴室、职工食堂或营业餐馆的厨房、体育场馆运动员休息室、剧院的化妆间、普通理化实验室等建筑的生活给水管道的的设计秒流量,应按下式计算:

$$q_g = \sum q_o N_o b \quad (3.6.6)$$

式中 q_g ——计算管段的给水设计秒流量 (L/s);

q_o ——同类型的一个卫生器具给水额定流量(L/s);

N_o ——同类型卫生器具数;

b ——卫生器具的同时给水百分数,应按表 3.6.6-1 ~ 表3.6.6-3采用。

**表 3.6.5 根据建筑物用途
而定的系数值 (α 值)**

建筑物名称	α 值	建筑物名称	α 值
幼儿园、托儿所、养老院	1.2	医院、疗养院、休养所	2.0
门诊部、诊疗所	1.4	集体宿舍、旅馆、招待所、宾馆	2.5
办公楼、商场	1.5	客运站、会展中心、公共厕所	3.0
学校	1.8		

注: 1 如计算值小于该管段上一个最大卫生器具给水额定流量时,应采用一个最大的卫生器具给水额定流量作为设计秒流量。

- 2 大便器自闭式冲洗阀应单列计算,当单列计算值小于 1.2L/s 时,以 1.2L/s 计;大于 1.2L/s 时,以计算值计。

**表 3.6.6-1 工业企业生活间、公共浴室、剧院化妆间、
体育场馆运动员休息室等卫生器具同时给水百分数**

卫生器具名称	同时给水百分数 (%)			
	工业企业生活间	公共浴室	剧院化妆间	体育场馆运动员休息室
洗涤盆 (池)	33	15	15	15
洗手盆	50	50	50	50
洗脸盆、盥洗槽水嘴	60 ~ 100	60 ~ 100	50	80
浴盆	—	50	—	—
无间隔淋浴器	100	100	—	100
有间隔淋浴器	80	60 ~ 80	60 ~ 80	60 ~ 100
大便器冲洗水箱	30	20	20	20
大便器自闭式冲洗阀	2	2	2	2
小便器自闭式冲洗阀	10	10	10	10
小便器 (槽) 自动冲洗水箱	100	100	100	100
净身盆	33	—	—	—
饮水器	30 ~ 60	30	30	30
小卖部洗涤盆	—	50	—	50

注: 健身中心的卫生间,可采用本表体育场馆运动员休息室的的同时给水百分率。

表 3.6.6-2 职工食堂、营业餐馆厨房设备同时给水百分数

厨房设备名称	同时给水百分数 (%)	厨房设备名称	同时给水百分数 (%)
污水盆 (池)	50	器皿洗涤机	90
洗涤盆 (池)	70	开水器	50
煮锅	60	蒸汽发生器	100
生产性洗涤机	40	灶台水嘴	30

注：职工或学生饭堂的洗碗台水嘴，按 100% 同时给水，但不与厨房用水叠加。

表 3.6.6-3 实验室化验水嘴同时给水百分数

化验水嘴名称	同时给水百分数 (%)	
	科学研究实验室	生产实验室
单联化验水嘴	20	30
双联或三联化验水嘴	30	50

3.6.7 建筑物内生活用水最大小时用水量，应按本规范表 3.1.9 和表 3.1.10 的规定计算确定。

3.6.8 住宅的入户管，公称直径不宜小于 20mm。

3.6.9 生活给水管道的的水流速度，宜按表 3.6.9 采用。

表 3.6.9 生活给水管道的的水流速度

公称直径 (mm)	15 ~ 20	25 ~ 40	50 ~ 70	≥ 80
水流速度 (m/s)	≤ 1.0	≤ 1.2	≤ 1.5	≤ 1.8

3.6.10 给水管道的沿程水头损失可按下式计算：

$$i = 105 C_h^{-1.85} d_j^{-4.87} q_g^{1.85} \quad (3.6.10)$$

式中 i ——管道单位长度水头损失 (kPa/m)；

d_j ——管道计算内径 (m)；

q_g ——给水设计流量 (m³/s)；

C_h ——海澄-威廉系数。

各种塑料管、内衬 (涂) 塑管 $C_h = 140$ ；

铜管、不锈钢管 $C_h = 130$ ；

衬水泥、树脂的铸铁管 $C_h = 130$ ；

普通钢管、铸铁管 $C_h = 100$ 。

3.6.11 生活给水管道的配水管的局部水头损失，宜按管道的连接方式，采用管 (配) 件当量长度法计算。当管道的管 (配) 件当量长度资料不足时，可按下列管件的连接状况，按管网的沿程水头损失的百分数取值：

1 管 (配) 件内径与管道内径一致，采用三通分水时，取 25% ~ 30%；采用分水器分水时，取 15% ~ 20%。

2 管 (配) 件内径略大于管道内径，采用三通分水时，取 50% ~ 60%；采用分水器分水时，取 30% ~ 35%。

3 管 (配) 件内径略小于管道内径，管 (配) 件的插口插入管口内连接，采用三通分水时，取 70% ~ 80%；采用分水器分水时，取 35% ~ 40%。

注：附录 B 为螺纹接口的阀门及管件的摩阻损失当量长度表。

3.6.12 水表的水头损失，应按选用产品所给定的压力损失值计算。在未确定具体产品

时,可按下列情况取用:

- 1 住宅入户管上的水表,宜取 0.01MPa;
 - 2 建筑物或小区引入管上的水表,在生活用水工况时,宜取 0.03MPa;在校核消防工况时,宜取 0.05MPa。
- 3.6.13 比例式减压阀的水头损失,阀后动水压宜按阀后静水压的 80%~90%采用。
- 3.6.14 管道过滤器的局部水头损失,宜取 0.01MPa。
- 3.6.15 管道倒流防止器的局部水头损失,宜取 0.025~0.04MPa。

3.7 水塔、水箱、贮水池

3.7.1 居住小区采用水塔作为生活用水的调节构筑物时,应符合下列规定:

- 1 水塔的有效容积应经计算确定;
- 2 水塔应有保温防冻措施。

3.7.2 居住小区加压泵站的贮水池,应符合下列规定:

- 1 居住小区加压泵站的贮水池有效容积,其生活用水调节量应按流入量和供出量的变化曲线经计算确定,资料不足时可按最高日用水量的 15%~20%确定。
- 2 贮水池宜分成容积基本相等的两格。

3.7.3 建筑物内的生活用水低位贮水池(箱)应符合下列规定:

- 1 贮水池(箱)的有效容积应按进水量与用水量变化曲线经计算确定;当资料不足时,宜按最高日用水量的 20%~25%确定。
- 2 池(箱)外壁与建筑本体结构墙面或其他池壁之间的净距,应满足施工或装配的需要,无管道的侧面,净距不宜小于 0.7m;安装有管道的侧面,净距不宜小于 1.0m,且管道外壁与建筑本体墙面之间的通道宽度不宜小于 0.6m;设有人孔的池顶,顶板面与上面建筑本体板底的净空不应小于 0.8m。
- 3 贮水池(箱)不宜毗邻电气用房和居住用房或在其下方。
- 4 贮水池内宜设有水泵吸水坑,吸水坑的大小和深度,应满足水泵吸水管的安装要求。

3.7.4 无调节要求的加压给水系统,可设置吸水井,吸水井的有效容积不应小于水泵 3min 设计秒流量。吸水井的其他要求应符合本规范 3.7.3 条的规定。

3.7.5 生活用水高位水箱应符合下列规定:

- 1 由城市给水管网夜间直接进水的高位水箱的生活用水调节容积,宜按用水人数和最高日用水定额确定;由水泵联动提升进水的水箱的生活用水调节容积,不宜小于最大用水时水量的 50%;
- 2 高位水箱箱壁与水箱间墙壁及箱顶与水箱间顶面的净距应符合本规范 3.7.3 条第 2 款规定,箱底与水箱间地面板的净距,当有管道敷设时不宜小于 0.8m;
- 3 水箱的设置高度(以底板面计)应满足最高层用户的用水水压要求,如达不到要求时,宜在其入户管上设置管道泵增压。

3.7.6 建筑物贮水池(箱)应设置在通风良好、不结冻的房间内。

3.7.7 水塔、水池、水箱等构筑物应设进水管、出水管、溢流管、泄水管和信号装置,并应符合下列要求:

1 水池(箱)设置和管道布置应符合本规范 3.2.9、3.2.10、3.2.12 和 3.2.13 条有关防止水质污染的规定。

2 进、出水管宜分别设置。

3 当利用城市给水管网压力直接进水时,应设置自动水位控制阀,控制阀直径与进水管管径相同,当采用浮球阀时不宜少于两个,且进水管标高应一致。

4 当水箱采用水泵加压进水时,进水管不得设置自动水位控制阀,应设置水箱水位自动控制水泵开、停的装置。当水泵供给多个水箱进水时,应在水箱进水管上装设电动阀,由水位监控设备实现自动控制。电动阀应与进水管管径相同。

5 溢流管宜采用水平喇叭口集水;喇叭口下的垂直管段不宜小于 4 倍溢流管管径。溢流管的管径,应按能排泄水塔(池、箱)的最大入流量确定,并宜比进水管管径大一级。

6 泄水管的管径,应按水池(箱)泄空时间和泄水受体排泄能力确定。当水池(箱)中的水不能以重力自流泄空时,应设置移动或固定的提升装置。

7 水塔、水池应设水位监视溢流报警装置,水箱宜设置水位监视和溢流报警装置。信息应传至监控中心。

3.7.8 生活用水中途转输水箱的转输调节容积宜取 5~10min 转输水泵的流量。

3.8 增压设备、泵房

3.8.1 选择生活给水系统的加压水泵,应遵守下列一般规定:

1 水泵的 $Q \sim H$ 特性曲线,应是随流量的增大,扬程逐渐下降的曲线。

注:对 $Q \sim H$ 特性曲线存在有上升段的水泵,应分析在运行工况中不会出现不稳定工作时方可采用。

2 应根据管网水力计算进行选泵,水泵应在其高效区内运行。

3 生活加压给水系统的水泵机组应设备用泵,备用泵的供水能力不应小于最大一台运行水泵的供水能力。水泵宜自动切换交替运行。

3.8.2 居住小区的加压泵站,当给水管网无调节设施时,宜采用调速泵组或额定转速泵编组运行供水。泵组的最大出水量不应小于小区给水设计流量,并应以消防工况校核。

3.8.3 建筑物内采用高位水箱调节的生活给水系统时,水泵的最大出水量不应小于最大小时用水量。

3.8.4 生活给水系统采用调速泵组供水时,应按设计秒流量选泵,调速泵在额定转速时的工作点,应位于水泵高效区的末端。

3.8.5 生活给水系统采用气压给水设备供水时,应符合下列规定:

1 气压水罐内的最低工作压力,应满足管网最不利处的配水点所需水压;

2 气压水罐内的最高工作压力,不得使管网最大水压处配水点的水压大于 0.55MPa;

3 水泵(或泵组)的流量(以气压水罐内的平均压力计,其对应的水泵扬程的流量),不应小于给水系统最大小时用水量的 1.2 倍;

4 气压水罐的调节容积按下式计算:

$$V_{q2} = \frac{\alpha_a q_b}{4n_q} \quad (3.8.5-1)$$

式中 V_{q2} ——气压水罐的调节容积 (m^3);

q_h ——水泵（或泵组）的出流量（ m^3/h ）；

α_a ——安全系数，宜取 1.0~1.3；

n_q ——水泵在 1h 内的启动次数，宜采用 6~8 次。

5 气压水罐的总容积按下式计算：

$$V_q = \frac{\beta V_{q1}}{1 - \alpha_b} \quad (3.8.5-2)$$

式中 V_q ——气压水罐总容积（ m^3 ）；

V_{q1} ——气压水罐的水容积（ m^3 ）；应等于或大于调节容量；

α_b ——气压水罐内的工作压力比（以绝对压力计），宜采用 0.65~0.85；

β ——气压水罐的容积系数，隔膜式气压水罐取 1.05。

3.8.6 水泵宜自灌吸水，每台水泵宜设置单独从水池吸水的吸水管。吸水管内的流速宜采用 1.0~1.2m/s；吸水管口应设置向下的喇叭口，喇叭口低于水池最低水位，不宜小于 0.5m，达不到此要求时，应采取防止空气被吸入的措施。

吸水管喇叭口至池底的净距，不应小于 0.8 倍吸水管管径，且不应小于 0.1m；吸水管喇叭口边缘与池壁的净距不宜小于 1.5 倍吸水管管径；吸水管与吸水管之间的净距，不宜小于 3.5 倍吸水管管径（管径以相邻两者的平均值计）。

注：当水池水位不能满足水泵自灌启动水位时，应有防止水泵启动的保护措施。

3.8.7 当每台水泵单独从水池吸水有困难时，可采用单独从吸水总管上自灌吸水，吸水总管应符合下列规定：

1 吸水总管伸入水池的引水管不宜少于两条，当一条引水管发生故障时，其余引水管应能通过全部设计流量。每条引水管上应设闸门。

注：水池有独立的两个及以上的分格，每格有一条引水管，可视为有两条以上引水管。

2 引水管应设向下的喇叭口，喇叭口的设置应符合本规范 3.8.6 条中吸水管喇叭口的相应规定，但喇叭口低于水池最低水位的距离不宜小于 0.3m。

3 吸水总管内的流速应小于 1.2m/s。

4 水泵吸水管与吸水总管的连接，应采用管顶平接，或高出管顶连接。

3.8.8 自吸式水泵以水池最低水位计的允许安装高度，应根据当地的大气压力、最高水温时的饱和蒸汽压、水泵的汽蚀余量和吸水管路的水头损失，经计算确定，并应有不小于 0.3m 的安全余量。

3.8.9 每台水泵的出水管上，应装设压力表、止回阀和阀门（符合多功能阀安装条件的出水管，可用多功能阀取代止回阀和阀门），必要时应设置水锤消除装置。自灌式吸水的水泵吸水管上应装设阀门，并宜装设管道过滤器。

3.8.10 居住小区独立设置的水泵房，宜靠近用水大户，水泵机组的运行噪声应符合现行的国家标准《城市区域环境噪声标准》的要求。

3.8.11 民用建筑物内设置的水泵机组，宜设在吸水池的侧面或下方，其运行的噪声应符合《民用建筑隔声设计规范》的规定。

3.8.12 建筑物内的给水泵房，应采用下列减振防噪措施：

1 应选用低噪声水泵机组；

- 2 吸水管和出水管上应设置减振装置；
- 3 水泵机组的基础应设置减振装置；
- 4 管道支架、吊架和管道穿墙、楼板处，应采取防止固体传声措施；
- 5 必要时，泵房的墙壁和天花应采取隔音吸音处理。

3.8.13 设置水泵的房间，应设排水设施；通风应良好，不得结冻。

3.8.14 水泵机组的布置，应符合表 3.8.14 的规定：

表 3.8.14 水泵机组外轮廓面与墙和相邻机组间的间距

电动机额定功率 (kW)	水泵机组外廓面与墙面之间的最小间距 (m)	相邻水泵机组外轮廓面之间最小间距 (m)
≤22	0.8	0.4
> 25 ~ 55	1.0	0.8
≥55, ≤160	1.2	1.2

注：1 水泵侧面有管道时，外轮廓面计至管道外壁面。
2 水泵机组是指水泵与电动机的联合体，或已安装在金属座架上的多台水泵组合体。

3.8.15 水泵基础高出地面的高度应便于水泵安装，不应小于0.1m；泵房内管道管外底距地面或管沟底面的距离，当管径≤150mm时，不应小于0.2m；当管径大于等于200mm时，不应小于0.25m。

3.8.16 泵房内宜有检修水泵的场地，检修场地尺寸宜按水泵或电机外形尺寸四周有不小于0.7m的通道确定。泵房内宜设置手动起重设备。

3.9 游泳池和水上游乐池

3.9.1 世界级比赛用游泳池的池水水质卫生标准，应符合国际游泳协会（FINA）关于游泳池池水水质卫生标准的规定。

3.9.2 国家级比赛用游泳池和宾馆内附建的游泳池的池水水质卫生标准，可参照国际游泳协会（FINA）关于游泳池池水水质卫生标准的规定执行。其他游泳池和水上游乐池的池水水质应符合我国有关的卫生标准。

3.9.3 游泳池和水上游乐池的初次充水和使用过程中的补充水水质，应符合现行的《生活饮用水卫生标准》的要求。

3.9.4 游泳池和水上游乐池的饮水、淋浴等生活用水水质，应符合现行的《生活饮用水卫生标准》的要求。

3.9.5 游泳池和水上游乐池水宜循环使用。游泳池和水上游乐池的池水循环周期应根据池的类型、用途、池水容积、水深、使用人数等因数确定，一般可按表 3.9.5 采用。

3.9.6 水上游乐池循环水系统应根据水质、水温、水压和使用功能等因素，设计成一个

表 3.9.5 游泳池和水上游乐池的池水循环周期

序号	池 的 类 型		循环周期 (h)
1	比赛池、训练池		4 ~ 6
2	跳水池		8 ~ 10
3	俱乐部、宾馆内游泳池		6 ~ 8
4	公共游泳池		4 ~ 6
5	儿童池		2 ~ 4
6	幼儿戏水池		1 ~ 2
7	造浪池		2
8	按摩池	公 共	0.3 ~ 0.5
		专 用	0.5 ~ 1.0
9	滑道池、探险池		6
10	家庭游泳池		8 ~ 10

注：池水的循环次数可按每日使用时间与循环周期的比值确定。

或若干个独立的循环系统。

3.9.7 循环水应经过滤、加药和消毒处理，必要时还应进行加热。

3.9.8 循环水的预净化应在循环水泵的吸水管上装设毛发聚集器。

3.9.9 水上游乐池滑道润滑水系统的循环水泵，必须设置备用泵。

3.9.10 循环水过滤宜采用压力过滤器，压力过滤器应符合下列要求：

1 过滤器的滤速应根据池的类型、滤料种类确定。低速过滤器的滤速不宜大于 10m/h，中速过滤器的滤速宜为 10~25m/h，多层滤料过滤器的滤速宜为 20~30m/h。

2 过滤器的个数及单个过滤器面积，应根据循环流量的大小、运行维护等情况，通过技术经济比较确定，且不宜少于两个。

3 过滤器宜采用水进行反冲洗，冲洗管道不得与市政给水管网直接连接。

3.9.11 循环水在净化过程中应投加下列药剂：

1 过滤前投加混凝剂；

2 根据消毒剂品种，宜在消毒前投加 pH 值调节剂；

3 根据气候条件和池水水质变化，不定期地间断式投加除藻剂；

4 根据池水的 pH 值、总碱度、钙硬度、总溶解固体等水质参数，投加水质平衡药剂（水质平衡应保证池水的水质符合卫生标准要求）。

3.9.12 游泳池和水上游乐池的池水必须进行消毒杀菌处理。

3.9.13 消毒剂的选用应符合下列要求：

1 杀菌消毒能力强，并有持续杀菌功能；

2 不造成水和环境污染，不改变池水水质；

3 对人体无刺激或刺激性很小；

4 对建筑结构、设备和管道无腐蚀或轻微腐蚀；

5 费用低，且能就地取材。

3.9.14 使用瓶装氯气消毒时，氯气必须采用负压自动投加方式，严禁将氯直接注入游泳池水中的投加方式。加氯间应设置防毒、防火和防爆装置，并符合有关现行规范的规定。

3.9.15 游泳池和水上游乐池的池水设计温度应根据池的类型按表 3.9.15 确定。

3.9.16 游泳池和水上游乐池水加热所需热量应经计算确定，加热方式宜采用间接式。

3.9.17 游泳池和水上游乐池的初次充水时间，应根据使用性质、城市给水条件等确定，宜小于 24h，最长不得超过 48h。

3.9.18 游泳池和水上游乐池的补充水量可按表 3.9.18 确定。大型游泳池和水上游乐池应采用平衡水池或补充水箱间接补水，家庭游泳池等小型游泳池如采用直接补水，补充水管应采取有效的防止回流污染的措施。

表 3.9.15 游泳池和水上游乐池的池水设计温度

序号	池 的 类 型	池水设计温度 (℃)
1	室内池	比赛池
2		25~27
3		训练池、跳水池
4		26~28
5		俱乐部、宾馆内游泳池
6		26~28
7		公共游泳池
8	室外池	儿童池、幼儿戏水池
9		28~30
		滑道池
		28~29
		按摩池
		不高于 40
		有加热设备
		26~28
		无加热设备
		22~23

3.9.19 顺流式、混合式循环给水方式的游泳池和水上游乐池宜设置平衡水位的平衡水池，逆流式循环给水方式的游泳池和水上游乐池应设置平衡水量的均衡水池。

3.9.20 游泳池进水口和回水口的数量应满足循环流量的要求，设置位置应使游泳池内水流均匀、不产生涡流和短流。进水口格栅孔隙的水流速度不宜大于 1.0m/s ，回水口格栅孔隙的水流速度不应大于 0.2m/s 。进水口格栅孔隙的宽度不得大于 8mm ，池底回水口格栅孔隙的宽度成人池不得大于 10mm ，儿童池不得大于 8mm 。

3.9.21 游泳池泄水口应设置在池底的最低处，泄水口的数量按 4h 排空全部池水计算确定。游泳池宜设置池岸式溢流水槽。

3.9.22 进入公共游泳池和水上游乐池的通道，应设置浸脚消毒池。

3.9.23 游泳池和水上游乐池的管道、设备、容器、附件均应采用耐腐蚀材质或内壁涂衬耐腐蚀材料，材质与涂衬材料应符合有关卫生标准，不得影响池水水质。

3.9.24 比赛用跳水池必须设置水面制波装置。

3.9.25 跳水池的水面波浪应为均匀波纹小浪，浪高宜为 $25 \sim 40\text{mm}$ 。制波方法宜采用起泡法。

3.9.26 幼儿戏水池的水深宜为 $0.3 \sim 0.4\text{m}$ ，成人戏水池的水深宜为 1.0m 。

3.9.27 儿童游泳池的水深不得大于 0.6m ，当不同年龄段所用的池子合建在一起时，应采用栏杆将其分隔开。

表 3.9.18 游泳池和水上游乐池的补充水量

序号	池的类型和特征	每日补充水量占池水容积的百分数 (%)	
		室内	室外
1	比赛池、训练池、跳水池	室内	3 ~ 5
		室外	5 ~ 10
2	公共游泳池、游乐池	室内	5 ~ 10
		室外	10 ~ 15
3	儿童池、幼儿戏水池	室内	不小于 15
		室外	不小于 20
4	按摩池	专用	8 ~ 10
		公用	10 ~ 15
5	家庭游泳池	室内	3
		室外	5

注：游泳池和水上游乐池的最小补充水量应保证一个月內池水全部更新一次。

3.10 冷却塔及循环冷却水

3.10.1 设计循环冷却水系统时应符合下列要求：

- 1 循环冷却水系统宜采用敞开式；
- 2 对于水温、水质、运行等要求差别较大的设备，循环冷却水系统宜分开设置；
- 3 敞开式循环冷却水系统的水质应满足被冷却设备的水质要求；
- 4 设备、管道设计时应能使循环系统的余压充分利用。

3.10.2 冷却塔设计计算所选用的空气干球温度和湿球温度，应与所服务的空调等系统的设计空气干球温度和湿球温度相吻合，应采用历年平均不保证 50h 的干球温度和湿球温度。

3.10.3 冷却塔位置的选择应根据下列因素综合确定：

- 1 气流应通畅，湿热空气回流影响小，且应布置在建筑物的最小频率风向的上风侧。
- 2 冷却塔不应布置在热源、废气和烟气排放口附近，不宜布置在高大建筑物中间的狭长地带。

3 冷却塔与相邻建筑物之间的距离，除满足塔的通风要求外，还应考虑噪声、飘水等对建筑物的影响。

3.10.4 选用成品冷却塔时，应符合下列要求：

1 按生产厂家提供的热力特性曲线选定。设计循环水量不宜超过冷却塔的额定水量；当循环水量达不到额定水量的 80% 时，应对冷却塔的配水系统进行校核。

2 冷却塔应冷效高、能源省、噪声低、重量轻、体积小、寿命长、安装维护简单、飘水少。

3 材料应为阻燃型，并应符合防火要求。

4 数量宜与冷却水用水设备的数量、控制运行相匹配。

5 塔的形状应按建筑要求、占地面积及设置地点确定。

6 当冷却塔的布置不能满足 3.10.3 条的规定时，应采取相应的技术措施，并对塔的热力性能进行校核。

3.10.5 冷却塔的布置，应符合下列要求：

1 冷却塔宜单排布置。当需多排布置时，塔排之间的距离应保证塔排同时工作时的进风量。

2 单侧进风塔的进风面宜面向夏季主导风向，双侧进风塔的进风面宜平行夏季主导风向。

3 冷却塔进风侧离建筑物的距离宜大于塔进风口高度的 2 倍。冷却塔的四周除满足通风要求和管道安装位置外，还应留有检修通道。通道净距不宜小于 1.0m。

3.10.6 冷却塔应设置在专用的基础上，不得直接设置在楼板或屋面上。

3.10.7 环境对噪声要求较高时，可采取下列措施：

1 冷却塔的位置远离对噪声敏感的区域。

2 采用低噪声型或超低噪声型冷却塔。

3 进水管、出水管、补充水管上设置隔振防噪装置。

4 冷却塔基础设置隔振装置。

5 建筑上采取隔声吸音屏障。

3.10.8 循环水泵的台数宜与冷凝器相匹配，并宜设置备用水泵。

循环水泵的出水量应按冷却水循环水量确定，扬程应按设备和管网循环水压要求确定，并应复核水泵泵壳承压能力。

3.10.9 冷却塔循环管道的流速，宜采用下列数值：

1 循环干管管径小于等于 250mm 时，为 1.5 ~ 2.0m/s；管径大于 250mm、小于 500mm 时，为 2.0 ~ 2.5m/s；管径大于等于 500mm 时，为 2.5 ~ 3.0m/s。

2 当循环水泵从冷却塔集水池中吸水时，吸水管的流速宜采用 1.0 ~ 1.2m/s；当循环水泵直接从循环管道吸水，吸水管直径小于等于 250mm 时，流速宜为 1.0 ~ 1.5m/s，吸水管直径大于 250mm 时，流速宜为 1.5 ~ 2.0m/s。水泵出水管的流速可采用循环干管下限流速。

3.10.10 冷却塔集水池的设计，应符合下列要求：

1 集水池容积应按下列两项因素的水量之和确定：

1) 布水装置和淋水填料需附着，水量宜按循环水量的 1.2% ~ 1.5% 确定。

2) 水泵吸水口所需最小淹没深度应根据吸水管内流速确定,当流速小于等于 0.6m/s 时,最小淹没深度不应小于 0.3m;当流速为 1.2m/s 时,最小淹没深度不应小于 0.6m。

2 选用成品冷却塔时,应按本条第 1 款的规定,对其集水盘的容积进行核算,如不满足要求时,应加大集水盘深度或另设集水池。

3 不设集水池的多台冷却塔并联使用时,各塔的集水盘应设连通管,连通管的管径宜比总回水管的管径放大一号;连通管与各塔出水管的连接应为管顶平接。塔的出水口应采取防止空气吸入的措施。

4 每台(组)冷却塔应分别设置补充水管、泄水管、排污及溢流管。补水方式宜采用浮球阀或补充水箱。

当多台冷却塔共用集水池时,可设置一套补充水管、泄水管、排污及溢流管。

3.10.11 冷却塔补充水量可按下式计算:

$$q_{bc} = q_z + q_p + q_f = q_z N_n / (N_n - 1) \quad (3.10.11)$$

式中 q_{bc} ——补充水水量 (m^3/h);

q_z ——蒸发损失水量 (m^3/h);

q_p ——排污损失水量 (m^3/h);

q_f ——风吹损失水量 (m^3/h);

N_n ——浓缩倍数,设计浓缩倍数不宜小于 3.0。

注:对于建筑物空调、冷冻设备的补充水量,一般按冷却水循环水量的 1%~2% 确定。

3.10.12 建筑空调系统的循环冷却水的水质稳定处理应结合水质情况,合理选择处理方法及设备。当冷却水循环水量大于 $1000m^3/h$ 时,宜设置水质稳定处理、杀菌灭藻和旁流处理等装置。

3.10.13 旁流处理水量可根据去除悬浮物或溶解固体分别计算。当采用过滤处理去除悬浮物时,过滤水量宜为冷却水循环水量的 1%~5%。

3.11 水 景

3.11.1 水景水质应符合现行的《景观娱乐用水水质标准》中的规定。当喷头对水质有特殊要求时,循环水应进行过滤等处理。

3.11.2 喷泉用水应循环使用。循环系统的补充水量应根据蒸发、飘失、渗漏、排污等损失确定,室内工程宜取循环水流量的 1%~3%,室外工程取循环水流量的 3%~10%。

3.11.3 水景工程应根据喷头造型分组布置喷头。喷泉的每组射流应设调节装置。

3.11.4 水景工程管道应按不同特性的喷头设置配水管,配水管宜环状布置,水头损失宜采用 50~100Pa/m。管道改变方向处宜采用直管拐弯,不宜采用弯头、三通配件;管道变径处应采用异径管;喷嘴前应有不小于 20 倍喷嘴口直径的直线管段或设整流装置。

3.11.5 水景工程循环水泵宜采用潜水泵,直接设置于水池底。

水景工程循环水泵宜按不同特性的喷头、喷水系统分开设置。水景工程循环水泵的流量和扬程应按所选喷头形式、喷水高度、喷嘴直径和数量,以及管道系统的水头损失等经计算确定。

3.11.6 水景水池如采用生活饮用水作为补充水时，应采取防止回流污染的措施。

3.11.7 水景水池应设置补充水管、溢流管、泄水管。在池的周围宜设排水设施。

3.11.8 水景工程的运行方式可根据工程要求设计成手控、程控或声控；控制柜应按电气工程要求，设置于控制室内，控制室应干燥、通风。

3.11.9 瀑布、涌泉、溪流等水景工程设计，应符合下列要求：

- 1** 设计循环流量应为计算流量的 1.2 倍；
- 2** 水池设置应符合本规范 3.11.6 条和 3.11.7 条要求；
- 3** 电器控制可设置于附近小室内。

3.11.10 水景工程宜采用不锈钢等耐腐蚀管材。

4 排 水

4.1 系 统 选 择

- 4.1.1 新建居住小区应采用生活排水与雨水分流排水系统。
- 4.1.2 建筑物内下列情况下宜采用生活污水与生活废水分流的排水系统：
- 1 建筑物使用性质对卫生标准要求较高时；
 - 2 生活污水需经化粪池处理后才能排入市政排水管道时；
 - 3 生活废水需回收利用时。
- 4.1.3 下列建筑排水应单独排水至水处理或回收构筑物：
- 1 公共饮食业厨房含有大量油脂的洗涤废水；
 - 2 洗车台冲洗水；
 - 3 含有大量致病菌，放射性元素超过排放标准的医院污水；
 - 4 水温超过 40℃ 的锅炉、水加热器等加热设备排水；
 - 5 用作中水水源的生活排水。
- 4.1.4 建筑物雨水管道应单独设置，在缺水或严重缺水地区，宜设置雨水贮存池。

4.2 卫生器具及存水弯

- 4.2.1 卫生器具的设置数量，应符合现行的有关设计标准、规范或规定的要求。
- 4.2.2 卫生器具的材质和技术要求，均应符合现行的有关产品标准的规定。
- 4.2.3 大便器选用应根据使用对象、设置场所、建筑标准等因素确定，且均应选用节水型大便器。
- 4.2.4 公共场所设置小便器时，应采用延时自闭式冲洗阀或自动冲洗装置。
- 4.2.5 公共场所的洗手盆宜采用限流节水型装置。
- 4.2.6 构造内无存水弯的卫生器具与生活污水管道或其他可能产生有害气体的排水管道连接时，必须在排水口以下设存水弯。存水弯的水封深度不得小于 50mm。
- 4.2.7 医疗卫生机构内门诊、病房、化验室、试验室等处不在同一房间内的卫生器具不得共用存水弯。
- 4.2.8 卫生器具的安装高度可按表 4.2.8 确定。

表 4.2.8 卫生器具的安装高度

序 号	卫生器具名称	卫生器具边缘离地高度 (mm)	
		居住和公共建筑	幼 儿 园
1	架空式污水盆 (池) (至上边缘)	800	800
2	落地式污水盆 (池) (至上边缘)	500	500
3	洗涤盆 (池) (至上边缘)	800	800
4	洗手盆 (至上边缘)	800	500
5	洗脸盆 (至上边缘)	800	500
6	盥洗槽 (至上边缘)	800	500
7	浴盆 (至上边缘)	480	—

续表 4.2.8

序 号	卫生器具名称	卫生器具边缘离地高度 (mm)	
		居住和公共建筑	幼 儿 园
8	按摩浴盆 (至上边缘)	450	—
	淋浴盆 (至上边缘)	100	—
	蹲、坐式大便器 (从台阶面至高水箱底)	1800	1800
	蹲式大便器 (从台阶面至低水箱底)	900	900
10	坐式大便器 (至低水箱底)		
	外露排出管式	510	—
	虹吸喷射式	470	370
	冲落式	510	—
11	旋涡连体式	250	—
	坐式大便器 (至上边缘)		
	外露排出管式	400	—
	虹吸喷射式	380	—
12	冲落式	380	—
	旋涡连体式	360	—
	大便槽 (从台阶面至冲洗水箱底)	不低于 2000	—
	立式小便器 (至受水部分上边缘)	100	—
13	挂式小便器 (至受水部分上边缘)	600	450
14	小便槽 (至台阶面)	200	150
15	化验盆 (至上边缘)	800	—
16	净身器 (至上边缘)	360	—
17	饮水器 (至上边缘)	1000	—

4.3 管道布置和敷设

4.3.1 居住小区排水管的布置应根据小区规划、地形标高、排水流向,按管线短、埋深小、尽可能自流排出的原则确定。

4.3.2 居住小区排水管道最小覆土深度应根据道路的行车等级、管材受压强度、地基承载力等因素经计算确定,应符合下列要求:

- 1 小区干道和小区组团道路下的管道,覆土深度不宜小于 0.7m。
- 2 生活污水接户管道埋设深度不得高于土壤冰冻线以上 0.15m,且覆土深度不宜小于 0.3m。

4.3.3 建筑物内排水管道布置应符合下列要求:

- 1 自卫生器具至排出管的距离应最短,管道转弯应最少。
- 2 排水立管宜靠近排水量最大的排水点。
- 3 架空管道不得敷设在生产工艺或卫生有特殊要求的生产厂房内,以及食品和贵重商品仓库、通风小室、变配电间和电梯机房内。
- 4 排水管道不得穿过沉降缝、伸缩缝、变形缝、烟道和风道。
- 5 排水埋地管道,不得布置在可能受重物压坏处或穿越生产设备基础。
- 6 排水立管不得穿越卧室、病房等对卫生、安静有较高要求的房间,并不宜靠近与卧室相邻的内墙。
- 7 排水管道不宜穿越橱窗、壁柜。
- 8 塑料排水立管应避免布置在易受机械撞击处,如不能避免时,应采取保护措施。
- 9 塑料排水管应避免布置在热源附近,如不能避免,并导致管道表面受热温度大于 60℃时,应采取隔热措施。塑料排水立管与家用灶具边净距不得小于 0.4m。

- 10 排水管道外表面如可能结露,应根据建筑物性质和使用要求,采取防结露措施。
- 4.3.4 排水管道不得穿越生活饮用水池部位的上方。
- 4.3.5 室内排水管道不得布置在遇水会引起燃烧、爆炸的原料、产品和设备的上面。
- 4.3.6 排水横管不得布置在食堂、饮食业厨房的主副食操作烹调备餐的上方。当受条件限制不能避免时,应采取防护措施。
- 4.3.7 排水管道宜地下埋设或在地面上、楼板下明设,如建筑有要求时,可在管槽、管道井、管窿、管沟或吊顶内暗设,但应便于安装和检修。在气温较高、全年不结冻的地区,可沿建筑物外墙敷设。
- 4.3.8 住宅卫生间的卫生器具排水管不宜穿越楼板进入他户。
- 4.3.9 室内管道的连接应符合下列规定:
- 1 卫生器具排水管与排水横管垂直连接,应采用 90°斜三通。
 - 2 排水管道的横管与立管连接,宜采用 45°斜三通或 45°斜四通和顺水三通或顺水四通。
 - 3 排水立管与排出管端部的连接,宜采用两个 45°弯头或弯曲半径不小于 4 倍管径的 90°弯头。
 - 4 排水管应避免在轴线偏置,当受条件限制时,宜用乙字管或两个 45°弯头连接。
 - 5 支管接入横干管、立管接入横干管时,宜在横干管管顶或其两侧 45°范围内接入。
- 4.3.10 塑料排水管道应根据其管道的伸缩量设置伸缩节,伸缩节宜设置在汇合配件处。排水横管应设置专用伸缩节。

注:室内、外埋地管道可不设伸缩节。

4.3.11 建筑塑料排水管穿越楼层、防火墙、管道井井壁时,应根据建筑物性质、管径和设置条件,以及穿越部件防火等级等要求设置阻火装置。

4.3.12 靠近排水立管底部的排水支管连接,应符合下列要求:

1 排水立管仅设置伸顶通气管时,最低排水横支管与立管连接处距排水立管管底垂直距离不得小于表 4.3.12 的规定。

2 排水支管连接在排出管或排水横干管上时,连接点距立管底部下游水平距离不宜小于 3.0m,且不得小于 1.5m。

3 横支管接入横干管竖直转向管段时,连接点应距转向处以下不得小于 0.6m。

4 当靠近排水立管底部的排水支管的连接不能满足本条 1、2 款的要求时,排水支管应单独排至室外检查井或采取有效的防反压措施。

4.3.13 下列构筑物和设备的排水管不得与污废水管道系统直接连接,应采取间接排水的方式:

- 1 生活饮用水贮水箱(池)的泄水管和溢流管;
- 2 开水器、热水器排水;

表 4.3.12 最低横支管与立管连接处至立管管底的垂直距离

立管连接卫生器具的层数	垂直距离 (m)
≤4	0.45
5~6	0.75
7~12	1.2
13~19	3.0
≥20	6.0

注:当与排出管连接的立管底部放大一号管径或横干管比与之连接的立管大一号管径时,可将表中垂直距离缩小一档。

- 3 医疗灭菌消毒设备的排水；
- 4 蒸发式冷却器、空调设备冷凝水的排水；
- 5 贮存食品或饮料的冷藏库房的地面排水和冷风机溶霜水盘的排水。

4.3.14 设备间接排水宜排入邻近的洗涤盆、地漏。如不可能时，可设置排水明沟、排水漏斗或容器。间接排水口最小空气间隙，宜按表 4.3.14 确定。

4.3.15 间接排水的漏斗或容器不得产生溅水、溢流，并应布置在容易检查、清洁的位置。

4.3.16 生活废水在下列情况下，可采用有盖的排水沟排除：

- 1 废水中含有大量悬浮物或沉淀物需经常冲洗；
- 2 设备排水支管很多，用管道连接有困难；
- 3 设备排水点的位置不固定；
- 4 地面需要经常冲洗。

4.3.17 废水中如夹带纤维或有大块物体，应在排水管道连接处设置格栅或带网筐地漏。

4.3.18 室外排水管的连接应符合下列要求：

- 1 排水管与排水管连接，应用检查井连接。
- 2 室外排水管，除有水流跌落差以外，宜管顶平接。
- 3 排出管管顶标高不得低于室外接户管管顶标高。
- 4 连接处的水流偏转角不得大于 90°。当跌落差大于 0.3m 时，可不受角度的限制。

4.3.19 室内排水沟与室外排水管道连接处，应设水封装置。

4.3.20 排水管穿过地下室外墙或地下构筑物的墙壁处，应采取防水措施。

4.3.21 当建筑物沉降可能导致排出管倒坡时，应采取防倒坡措施。

4.3.22 排水管道在穿越楼层设套管且立管底部架空时，应在立管底部设支墩或其他固定措施。地下室立管与排水管转弯处也应设置支墩或固定措施。

表 4.3.14 间接排水口最小空气间隙

间接排水管管径 (mm)	排水口最小空气间隙 (mm)
≤25	50
32 ~ 50	100
> 50	150

注：饮料用贮水箱的间接排水口最小空气间隙，不得小于 150mm。

4.4 排水管道水力计算

4.4.1 居住小区生活排水系统排水定额是其相应的生活给水系统用水定额的 85% ~ 95%。

居住小区生活排水系统小时变化系数与其相应的生活给水系统小时变化系数相同，应按本规范 3.1.2 条和 3.1.3 条确定。

4.4.2 公共建筑生活排水定额和小时变化系数与公共建筑生活给水用水定额和小时变化系数相同，应按本规范 3.1.10 条规定确定。

4.4.3 居住小区内生活排水的设计流量应按住宅生活排水最大小时流量与公共建筑生活排水最大小时流量之和确定。

4.4.4 卫生器具排水的流量、当量和排水管的管径应按表 4.4.4 确定。

表 4.4.4 卫生器具排水的流量、当量和排水管的管径

序号	卫生器具名称	排水流量 (L/s)	当量	排水管管径 (mm)
1	洗涤盆、污水盆 (池)	0.33	1.00	50
2	餐厅、厨房洗菜盆 (池)			
	单格洗涤盆 (池)	0.67	2.00	50
	双格洗涤盆 (池)	1.00	3.00	50
3	盥洗槽 (每个水嘴)	0.33	1.00	50~75
4	洗手盆	0.10	0.30	32~50
5	洗脸盆	0.25	0.75	32~50
6	浴盆	1.00	3.00	50
7	淋浴器	0.15	0.45	50
8	大便器			
	高水箱	1.50	4.50	100
	低水箱			
	冲落式	1.50	4.50	100
	虹吸式、喷射虹吸式	2.00	6.00	100
	自闭式冲洗阀	1.50	4.50	100
9	医用倒便器	1.50	4.50	100
10	小便器			
	自闭式冲洗阀	0.10	0.30	40~50
	感应式冲洗阀	0.10	0.30	40~50
11	大便槽			
	≤4个蹲位	2.50	7.50	100
	>4个蹲位	3.00	9.00	150
12	小便槽 (每米长)			
	自动冲洗水箱	0.17	0.50	—
13	化验盆 (无塞)	0.20	0.60	40~50
14	净身器	0.10	0.30	40~50
15	饮水器	0.05	0.15	25~50
16	家用洗衣机	0.50	1.50	50

注：家用洗衣机排水软管，直径为 30mm，有上排水的家用洗衣机排水软管内径为 19mm。

4.4.5 住宅、集体宿舍、旅馆、医院、疗养院、幼儿园、养老院、办公楼、商场、会展中心、中小学教学楼等建筑生活排水管道设计秒流量，应按下式计算：

$$q_p = 0.12\alpha \sqrt{N_p} + q_{\max} \quad (4.4.5)$$

式中 q_p ——计算管段排水设计秒流量 (L/s)；

N_p ——计算管段的卫生器具排水当量总数；

α ——根据建筑物用途而定的系数，按表 4.4.5 确定；

$q_{\max}$ ——计算管段上最大一个卫生器具的排水流量 (L/s)。

表 4.4.5 根据建筑物用途而定的系数 α 值

建筑物名称	住宅、宾馆、医院、疗养院、幼儿园、养老院的卫生间	集体宿舍、旅馆和其他公共建筑的公共盥洗室和厕所间
α 值	1.5	2.0~2.5

注：如计算所得流量值大于该管段上按卫生器具排水流量累加值时，应按卫生器具排水流量累加值计。

4.4.6 工业企业生活间、公共浴室、洗衣房、职工食堂或营业餐厅的厨房、实验室、影剧院、体育场、候车 (机、船) 等建筑的生活管道排水设计秒流量，应按下式计算：

$$q_p = \sum q_o N_o b \quad (4.4.6)$$

式中 q_p ——计算管段排水设计秒流量 (L/s);

q_o ——同类型的一个卫生器具排水流量 (L/s);

N_o ——同类型卫生器具数;

b ——卫生器具的同时排水百分数, 按本规范第 3.6.6 条采用。冲洗水箱大便器的同时排水百分数应按 12% 计算。

注: 当计算排水流量小于一个大便器排水流量时, 应按一个大便器的排水流量计算。

4.4.7 排水横管的水力计算, 应按下式计算:

$$v = \frac{1}{n} R^{2/3} I^{1/2} \quad (4.4.7)$$

式中 v ——速度 (m/s);

R ——水力半径 (m);

I ——水力坡度, 采用排水管的坡度;

n ——粗糙系数。铸铁管为 0.013; 混凝土管、钢筋混凝土管为 0.013 ~ 0.014; 钢管为 0.012; 塑料管为 0.009。

4.4.8 居住小区生活排水管道的最小管径、最小设计坡度和最大设计充满度宜按表 4.4.8 确定。

表 4.4.8 居住小区室外生活排水管道最小管径、最小设计坡度和最大设计充满度

管 别	管 材	最小管径 (mm)	最小设计坡度	最大设计充满度
接户管	埋地塑料管	160	0.005	0.5
	混凝土管	150	0.007	
支管	埋地塑料管	160	0.005	0.55
	混凝土管	200	0.004	
干管	埋地塑料管	200	0.004	
	混凝土管	300	0.003	

注: 接户管管径不得小于建筑物排出管管径。

4.4.9 建筑物内生活排水铸铁管道的最小坡度和最大设计充满度, 宜按表 4.4.9 确定。

表 4.4.9 建筑物内生活排水铸铁管道的最小坡度和最大设计充满度

管径 (mm)	通用坡度	最小坡度	最大设计充满度
50	0.035	0.025	0.5
75	0.025	0.015	
100	0.020	0.012	
125	0.015	0.010	
150	0.010	0.007	0.6
200	0.008	0.005	

4.4.10 建筑排水塑料管排水横支管的标准坡度应为 0.026。排水横干管的坡度可按表 4.4.10 调整。

表 4.4.10 建筑排水塑料管排水横干管的最小坡度和最大设计充满度

外 径 (mm)	最 小 坡 度	最大设计充满度
110	0.004	0.5
125	0.0035	0.5
160	0.003	0.6
200	0.003	0.6

4.4.11 生活排水立管的最大排水能力，应按表 4.4.11-1 ~ 表4.4.11-4 确定。立管管径不得小于所连接的横支管管径。

表 4.4.11-1 设有通气管系的铸铁排水立管最大排水能力

排水立管管径 (mm)	排水能力 (L/s)	
	仅设伸顶通气管	有专用通气立管 或主通气立管
50	1.0	—
75	2.5	5
100	4.5	9
125	7.0	14
150	10.0	25

表 4.4.11-2 设有通气管系的塑料排水立管最大排水能力

排水立管管径 (mm)	排水能力 (L/s)	
	仅设伸顶通气管	有专用通气立管 或主通气立管
50	1.2	—
75	3.0	—
90	3.8	—
110	5.4	10.0
125	7.5	16.0
160	12.0	28.0

注：表内数据系在立管底部放大一号管径条件下的通水能力，如不放大时，可按表 4.4.11-1 确定。

表 4.4.11-3 单立管排水系统的立管最大排水能力

排水立管管径 (mm)	排水能力 (L/s)		
	混合器	塑料螺旋管	旋流器
75	—	3.0	—
100	6.0	6.0	7.0
125	9.0	—	10.0
150	13.0	13.0	15.0

表 4.4.11-4 不通气的生活排水立管最大排水能力

立管工作高度 (m)	排水能力 (L/s)				
	立管管径 (mm)				
	50	75	100	125	150
≤2	1.00	1.70	3.80	5.00	7.00
3	0.64	1.35	2.40	3.40	5.00
4	0.50	0.92	1.76	2.70	3.50
5	0.40	0.70	1.36	1.90	2.80
6	0.40	0.50	1.00	1.50	2.20

续表 4.4.11-4

立管工作高度 (m)	排水能力 (L/s)				
	立管管径 (mm)				
	50	75	100	125	150
7	0.40	0.50	0.76	1.20	2.00
≥8	0.40	0.50	0.64	1.00	1.40

注：1 排水立管工作高度，按最高排水横支管和立管连接处距排出管中心线间的距离计算。

2 如排水立管工作高度在表中是列出的两个高度值之间时，可用内插法求得排水立管的最大排水能力数值。

3 排水管管径为 100mm 的塑料管外径为 110mm，排水管管径为 150mm 的塑料管外径为 160mm。

4.4.12 大便器排水管最小管径不得小于 100mm。

4.4.13 建筑物内排出管最小管径不得小于 50mm。

4.4.14 多层住宅厨房间的立管管径不宜小于 75mm。

4.4.15 下列场所设置排水横管时，管径的确定应符合下列要求：

1 建筑底层排水管道与其楼层管道分开单独排出时，其排水横支管管径可按表 4.4.11-4 中立管工作高度 ≤2m 的数值确定。

2 公共食堂厨房内的污水采用管道排除时，其管径比计算管径大一级，但干管管径不得小于 100mm，支管管径不得小于 75mm。

3 医院污物洗涤盆（池）和污水盆（池）的排水管管径，不得小于 75mm。

4 小便槽或连接 3 个及 3 个以上的小便器，其污水支管管径，不宜小于 75mm。

5 浴池的泄水管管径宜采用 100mm。

4.5 管材、附件和检查井

4.5.1 排水管材选择应符合下列要求：

1 居住小区内排水管道，宜采用埋地排水塑料管、承插式混凝土管或钢筋混凝土管。当居住小区内设有生活污水处理装置时，生活排水管道应采用埋地排水塑料管。

2 建筑内部排水管道应采用建筑排水塑料管及管件或柔性接口机制排水铸铁管及相应管件。

3 当排水温度大于 40℃ 时，应采用金属排水管或耐热塑料排水管。

4.5.2 室外排水管道的连接在下列情况下应采用检查井：

1 在管道转弯和连接支管处；

2 在管道的管径、坡度改变处。

4.5.3 室外生活排水管道管径小于等于 150mm 时，检查井间距不宜大于 20m。管径大于等于 200mm 时，检查井间距不宜大于 30m。

4.5.4 生活排水管道不宜在建筑物内设检查井。当必须设置时，应采取密闭措施。

4.5.5 检查井的内径应根据所连接的管道管径、数量和埋设深度确定。井深小于或等于 1.0m 时，井内径可小于 0.7m；井深大于 1.0m 时，其内径不宜小于 0.7m。

注：井深系指盖板顶面至井底的深度，方形检查井的内径指内边长。

4.5.6 生活排水管道的检查井内应做导流槽。

- 4.5.7 厕所、盥洗室、卫生间及其他需经常从地面排水的房间，应设置地漏。
- 4.5.8 地漏应设置在易溅水的器具附近地面的最低处。
- 4.5.9 带水封的地漏水封深度不得小于 50mm。
- 4.5.10 地漏的选择应符合下列要求：
- 1 应优先采用直通式地漏。
 - 2 卫生标准要求高或非经常使用地漏排水的场所，应设置密闭地漏。
 - 3 食堂、厨房和公共浴室等排水宜设置网框式地漏。
- 4.5.11 淋浴室内地漏的排水负荷，可按表 4.5.11 确定。当用排水沟排水时，8 个淋浴器可设置一个直径为 100mm 的地漏。
- 4.5.12 在生活排水管道上，应按下列规定设置检查口和清扫口：

表 4.5.11 淋浴室地漏管径

淋浴器数量 (个)	地漏管径 (mm)
1~2	50
3	75
4~5	100

1 铸铁排水立管上检查口之间的距离不宜大于 10m，塑料排水立管宜每六层设置一个检查口。但在建筑物最低层和设有卫生器具的二层以上建筑物的最高层，应设置检查口，当立管水平拐弯或有乙字管时，在该层立管拐弯处和乙字管的上部应设检查口。

2 在连接 2 个及 2 个以上的大便器或 3 个及 3 个以上卫生器具的铸铁排水横管上，宜设置清扫口。

在连接 4 个及 4 个以上的大便器的塑料排水横管上宜设置清扫口。

3 在水流偏转角大于 45°的排水横管上，应设检查口或清扫口。

注：可采用带清扫口的转角配件替代。

4 当排水立管底部或排出管上的清扫口至室外检查井中心的最大长度大于表 4.5.12-1 的数值时，应在排出管上设清扫口。

表 4.5.12-1 排水立管或排出管上的清扫口至室外检查井中心的最大长度

管径 (mm)	50	75	100	100 以上
最大长度 (m)	10	12	15	20

5 排水横管的直线管段上检查口或清扫口之间的最大距离，应符合表 4.5.12-2 的规定。

表 4.5.12-2 排水横管的直线管段上检查口或清扫口之间的最大距离

管道管径 (mm)	清扫设备种类	距离 (m)	
		生活废水	生活污水
50~75	检查口	15	12
	清扫口	10	8
100~150	检查口	20	15
	清扫口	15	10
200	检查口	25	20

4.5.13 在排水管道上设置清扫口，应符合下列规定：

1 在排水横管上设清扫口，宜将清扫口设置在楼板或地坪上，且与地面相平。排水横管起点的清扫口与其端部相垂直的墙面的距离不得小于 0.15m。

2 排水管起点设置堵头代替清扫口时，堵头与墙面应有不小于 0.4m 的距离。

注：可利用带清扫口弯头配件代替清扫口。

3 在管径小于 100mm 的排水管道上设置清扫口，其尺寸应与管道同径；管径等于或大于 100mm 的排水管道上设置清扫口，应

采用 100mm 直径清扫口。

4 铸铁排水管道设置的清扫口，其材质应为铜质；硬聚氯乙烯管道上设置的清扫口应与管道同质。

5 排水横管连接清扫口的连接管管件应与清扫口同径，并采用 45°斜三通和 45°弯头或由 2 个 45°弯头组合的管件。

4.5.14 在排水管上设置检查口应符合下列规定：

1 立管上设置检查口，应在地（楼）面以上 1.0m，并应高于该层卫生器具上边缘 0.15m。

2 埋地横管上设置检查口时，检查口应设在砖砌的井内。

3 地下室立管上设置检查口时，检查口应设置在立管底部之上。

4 立管上检查口检查盖应面向便于检查清扫的方位；横干管上的检查口应垂直向上。

4.6 通 气 管

4.6.1 生活排水管道的立管顶端，应设置伸顶通气管。

注：当无条件设置伸顶通气管时，可设置不透气立管。

4.6.2 下列情况下应设置专用通气管：

1 生活排水立管所承担的卫生器具排水设计流量，当超过表 4.4.11-1、表 4.4.11-2 中仅设伸顶通气管的排水立管最大排水能力时，应设专用通气立管。

2 建筑标准要求较高的多层住宅和公共建筑、10 层及 10 层以上高层建筑的生活污水立管宜设置专用通气立管。

4.6.3 下列排水管段应设置环形通气管：

1 连接 4 个及 4 个以上卫生器具且横支管的长度大于 12m 的排水横支管；

2 连接 6 个及 6 个以上大便器的污水横支管；

3 设有器具通气管。

4.6.4 对卫生、安静要求较高的建筑物内，生活排水管道宜设置器具通气管。

4.6.5 建筑物内各层的排水管道上设有环形通气管时，应设置连接各层环形通气管的主通气立管或副通气立管。

4.6.6 伸顶通气管不允许或不可能单独伸出屋面时，可设置汇合通气管。

4.6.7 通气立管不得接纳器具污水、废水和雨水，不得与风道和烟道连接。

4.6.8 在建筑物内不得设置吸气阀替代通气管。

4.6.9 通气管和排水管的连接，应遵守下列规定：

1 器具通气管应设在存水弯出口端。在横支管上设环形通气管时，应在其最始端的两个卫生器具间接出，并应在排水支管中心线以上与排水支管呈垂直或 45°连接。

2 器具通气管、环形通气管应在卫生器具上边缘以上不少于 0.15m 处按不小于 0.01 的上升坡度与通气立管相连。

3 专用通气立管和主通气立管的上端可在最高层卫生器具上边缘或检查口以上与排水立管通气部分以斜三通连接。下端应在最低排水横支管以下与排水立管以斜三通连接。

4 专用通气立管应每隔 2 层、主通气立管宜每隔 8~10 层设结合通气管与排水立管连接。结合通气管下端宜在排水横支管以下与排水立管以斜三通连接；上端可在卫生器具

上边缘以上不小于 0.15m 处与通气立管以斜三通连接。

5 当用 H 管件替代结合通气管时, H 管与通气管的连接点应设在卫生器具上边缘以上不小于 0.15m 处。

6 当污水立管与废水立管合用一根通气立管时, H 管配件可隔层分别与污水立管和废水立管连接。但最低横支管连接点以下应装设结合通气管。

4.6.10 高出屋面的通气管设置应符合下列要求:

1 通气管高出屋面不得小于 0.3m, 且应大于最大积雪厚度, 通气管顶端应装设风帽或网罩。

注: 屋顶有隔热层时, 应从隔热层板面算起。

2 在通气管口周围 4m 以内有门窗时, 通气管口应高出窗顶 0.6m 或引向无门窗一侧。

3 在经常有人停留的平屋面上, 通气管口应高出屋面 2m 并应根据防雷要求考虑防雷装置。

4 通气管口不宜设在建筑物挑出部分(如屋檐檐口、阳台和雨篷等)的下面。

4.6.11 通气管的管径, 应根据排水能力、管道长度确定, 不宜小于排水管管径的 1/2, 其最小管径可按表 4.6.11 确定。

表 4.6.11 通气管最小管径

通气管名称	排水管管径 (mm)						
	32	40	50	75	100	125	150
器具通气管	32	32	32	—	50	50	—
环形通气管	—	—	32	40	50	50	—
通气立管	—	—	40	50	75	100	100

注: 表中通气立管系指专用通气立管、主通气立管、副通气立管。

4.6.12 通气立管长度在 50m 以上时, 其管径应与排水立管管径相同。

4.6.13 通气立管长度小于等于 50m 时, 且两根及两根以上排水立管同时与一根通气立管相连, 应以最大一根排水立管按表 4.6.11 确定通气立管径, 且其管径不宜小于其余任何一根排水立管管径。

4.6.14 结合通气管的管径不宜小于通气立管管径。

4.6.15 伸顶通气管管径宜与排水立管管径相同。但在最冷月平均气温低于 -13°C 的地区, 应在室内平顶或吊顶以下 0.3m 处将管径放大一级。

4.6.16 当两根或两根以上污水立管的通气管汇合连接时, 汇合通气管的断面积应为最大一根通气管的断面积加其余通气管断面积之和的 0.25 倍。

4.6.17 通气管的管材, 可采用塑料管、柔性接口排水铸铁管等。

4.7 污水泵和集水池

4.7.1 居住小区污水管道不能以重力自流排入市政污水管道时, 应设置污水泵房。污水泵房应建成单独构筑物, 并应有卫生防护隔离带。泵房设计应按现行的《室外排水设计规范》执行。

4.7.2 建筑物地下室生活排水, 应设置污水集水池和污水泵提升排至室外检查井。地下

室地坪排水应设集水坑和提升装置。

4.7.3 污水泵宜单独设置排水管排至室外，排出管的横管段应有坡度坡向出口。当2台或2台以上水泵共用一条出水管时，应在每台水泵出水管上装设阀门和止回阀；单台水泵排水有可能产生倒灌时，应设置止回阀。

4.7.4 公共建筑内应以每个生活污水集水池为单元设置一台备用泵。

注：地下室、设备机房、车库冲洗地面的排水，如有2台及2台以上排水泵时可不设备用泵。

4.7.5 当集水池不能设事故排出管时，污水泵应有不间断的动力供应。

注：如能关闭污水进水管时，可不设不间断动力供应。

4.7.6 污水水泵的启闭，应设置自动控制装置。多台水泵可并联交替或分段投入运行。

4.7.7 污水水泵流量、扬程的选择，应符合下列规定：

- 1 居住小区污水水泵的流量应按小区最大小时生活排水流量选定。
- 2 建筑物内的污水水泵的流量应按生活排水设计秒流量选定。当有排水量调节时，可按生活排水最大小时流量选定。

- 3 水泵扬程应按提升高度、管路系统水头损失、另附加2~3m流出水头计算。

4.7.8 集水池设计应符合下列规定：

- 1 集水池有效容积不宜小于最大一台污水泵5min的出水量，且污水泵每小时启动次数不宜超过6次。
- 2 集水池除满足有效容积外，还应满足水泵设置、水位控制器、格栅等安装、检查要求。
- 3 集水池设计最低水位，应满足水泵吸水要求。
- 4 集水池如设置在室内地下室时，池盖应密封，并设通气管系；室内有敞开的集水池时，应设强制通风装置。
- 5 集水池底应有不小于0.05坡度坡向泵位。集水坑的深度及其平面尺寸，应按水泵类型而定。
- 6 集水池底宜设置自冲管。
- 7 集水池应设置水位指示装置，必要时应设置超警戒水位报警装置，将信号引至物业管理中心。

4.7.9 生活排水调节池的有效容积不得大于6h生活排水平均小时流量。

4.7.10 污水泵、阀门、管道等应选择耐腐蚀、大流通量、不易堵塞的设备器材。

4.8 小型生活污水处理

4.8.1 职工食堂和营业餐厅的含油污水，应经除油装置后方许排入污水管道。

4.8.2 隔油池设计应符合下列规定：

- 1 污水流量应按设计秒流量计算；
- 2 含食用油污水在池内的流速不得大于0.005m/s；
- 3 含食用油污水在池内停留时间宜为2~10min；
- 4 人工除油的隔油池内存油部分的容积，不得小于该池有效容积的25%；
- 5 隔油池应设活动盖板。进水管应考虑有疏通的可能；
- 6 隔油池出水管管底至池底的深度，不得小于0.6m。

4.8.3 降温池的设计应符合下列规定：

1 温度高于 40℃的排水，应首先考虑将所含热量回收利用，如不可能或回收不合理时，在排入城镇排水管道之前应设降温池。降温池应设置于室外。

2 降温宜采用较高温度排水与冷水在池内混合的方法进行。冷却水应尽量利用低温废水。所需冷却水量应按热平衡方法计算。

3 降温池的容积应按下列规定确定：

1) 间断排放污水时，应按一次最大排水量与所需冷却水量的总和计算有效容积。

2) 连续排放污水时，应保证污水与冷却水能充分混合。

4 降温池管道设置应符合下列要求：

1) 有压高温污水进水管口宜装设消音设施，有两次蒸发时，管口应露出水面向上并应采取防止烫伤人的措施。无两次蒸发时，管口宜插进水中深度 200mm 以上。

2) 冷却水与高温水混合可采用穿孔管喷洒，如采用生活饮用水作冷却水时，应采取防回流污染措施。

3) 降温池虹吸排水管管口应设在水池底部。

4) 应设排气管，排气管排出口设置位置应符合安全、环保要求。

4.8.4 化粪池距离地下水取水构筑物不得小于 30m。

4.8.5 化粪池的设置应符合下列要求：

1 化粪池宜设置在接户管的下游端，便于机动车清掏的位置。

2 化粪池池外壁距建筑物外墙不宜小于 5m，并不得影响建筑物基础。

注：当受条件限制化粪池设置于建筑物内时，应采取通气、防臭和防爆措施。

4.8.6 化粪池有效容积应为污水部分和污泥部分容积之和。其计算参数应符合下列规定：

1 每人每日污水量和污泥量，应按表 4.8.6-1 确定。

表 4.8.6-1 每人每日污水量和污泥量

分 类	生活污水与生活废水合流排出	生活污水单独排出
每人每日污水量 (L)	与用水量相同	20 ~ 30
每人每日污泥量 (L)	0.7	0.4

2 污水在池中停留时间应根据污水量确定，宜采用 12 ~ 24h。

3 污泥清掏周期应根据污水温度和当地气候条件确定，宜采用 3 ~ 12 个月。

4 新鲜污泥含水率可按 95%，发酵浓缩后的污泥含水率可按 90% 计算。

5 污泥发酵后体积缩减系数宜取 0.8。

6 清掏污泥后遗留熟污泥量的容积应按污泥部分容积的 20% 计算。

7 化粪池实际使用人数占总人数的百分数可按表 4.8.6-2 确定。

表 4.8.6-2 化粪池使用人数百分数

建筑物名称	百分数 (%)
医院、疗养院、养老院、幼儿园 (有住宿)	100
住宅、集体宿舍、旅馆	70
办公楼、教学楼、试验楼、工业企业生活间	40
职工食堂、餐饮业、影剧院、体育场 (馆)、商场和其他场所 (按座位)	10

4.8.7 化粪池的构造，应符合下列要求：

1 化粪池的长度与深度、宽度的比例应按污水中悬浮物的沉降条件和积存数量，经水力计算确定，但深度（水面至池底）不得小于1.3m，宽度不得小于0.75m，长度不得小于1.0m，圆形化粪池直径不得小于1.0m。

2 双格化粪池第一格的容量宜为计算总容量的75%，三格化粪池第一格的容量宜为总容量的60%，第二格和第三格各宜为总容量的20%。

3 化粪池格与格、池与连接井之间应设通气孔洞。

4 化粪池进水口、出水口应设置连接井与进水管、出水管相接。

5 化粪池进水管口应设导流装置，出水口处及格与格之间应设拦截污泥浮渣的设施。

6 化粪池池壁和池底，应防止渗漏。

7 化粪池顶板上应设有人孔和盖板。

4.8.8 医院污水必须进行消毒处理。处理后的水质，按排放条件应符合现行的《医疗机构污水排放要求》。

4.8.9 医院污水处理流程应根据污水性质、排放条件等因素确定，一般排入城市下水道时，宜采用一级处理；排入地表水体时，应采用二级处理。

4.8.10 医院污水处理构筑物，与病房、医疗室、住宅等宜有卫生防护隔离带。

4.8.11 传染病房的污水，如经技术经济比较认为合理时，可与普通病房污水分别进行处理。

4.8.12 经消毒处理后的污水，不得排入生活饮用水的集中取水点上游1000m和下游100m的水体范围内。

经消毒处理后的污水，如排入娱乐和体育用水水体、渔业用水水体时，还应符合有关标准要求。

4.8.13 化粪池作为医院污水消毒前的预处理时，化粪池的容积应按污水在池内停留时间不小于36h计算，污泥清掏周期宜为1a。

4.8.14 医院污水消毒一般宜采用氯消毒（成品次氯酸钠、氯片、漂白粉、漂粉精或液氯）。如运输或供应困难时，可采用现场制备次氯酸钠、化学法制备二氧化氯消毒方式。

如有特殊要求并经技术经济比较认为合理，可采用臭氧消毒法。

4.8.15 医院建筑内含放射性物质、重金属及其他有毒、有害物质的污水，如不符合排放标准时，需进行单独处理后，方可排入医院污水处理站或城市排水管道。

4.8.16 医院污水处理系统的污泥，宜由城市环卫部门集中处置。当城镇无集中处置条件时，可采用高温堆肥或石灰消化方法处理。

4.8.17 生活污水处理设施的工艺流程应根据污水性质、回用或排放要求确定。

4.8.18 生活污水处理设施的设置应符合下列要求：

1 宜靠近接入市政管道的排放点；

2 居住小区处理站的位置宜在常年最小频率的上风向，且应用绿化带与建筑物隔开；

3 处理站宜设置在绿地、停车坪及室外空地的地下；

4 处理站如布置在建筑地下室时，应有专用隔间；

5 处理站与给水泵站及清水池水平距离不得小于 10m。

4.8.19 设置生活污水处理设施的房间或地下室应有良好的通风系统，当处理构筑物为敞开式时，每小时换气次数不宜小于 15 次，当处理设施有盖板时，每小时换气次数不宜小于 5 次。

4.8.20 生活污水处理应设置排臭系统，其排放口位置应避免对周围人、畜、植物造成危害和影响。

4.8.21 生活污水处理构筑物机械运行噪声不得超过现行的国家标准《城市区域环境噪声标准》和《民用建筑隔声设计规范》的要求。对建筑物内运行噪声较大的机械应设独立隔间。

4.9 雨 水

4.9.1 屋面雨水排水系统应迅速、及时地将屋面雨水排至室外雨水管渠或地面。

4.9.2 设计雨水流量应按式计算：

$$q_y = \frac{q_j \Psi F_w}{10000} \quad (4.9.2)$$

式中 q_y ——设计雨水流量 (L/s)；
 q_j ——设计降雨强度 (L/s·ha)；
 Ψ ——径流系数；
 F_w ——汇水面积 (m²)。

4.9.3 设计降雨强度应按当地或相邻地区暴雨强度公式计算确定。

4.9.4 建筑屋面、建筑物基地、居住小区的雨水管道的设计降雨历时，可按下列规定确定：

- 1 屋面雨水排水管道设计降雨历时按 5min 计算。
- 2 居住小区雨水管道设计降雨历时应按式计算：

$$t = t_1 + Mt_2 \quad (4.9.4)$$

式中 t ——降雨历时 (min)；
 t_1 ——地面集流时间 (min)，视距离长短、地形坡度和地面铺盖情况而定，一般可选用 5~10min；
 M ——折减系数，小区支管和接户管： $M=1$ ；小区干管：暗管 $M=2$ ，明沟 $M=1.2$ ；
 t_2 ——排水管内雨水流行时间 (min)。

4.9.5 屋面雨水排水管道的排水设计重现期应根据建筑物的重要程度、汇水区域性质、地形特点、气象特征等因素确定，各种汇水区域的设计重现期不宜小于表 4.9.5 中规定的数值：

表 4.9.5 各种汇水区域的设计重现期

汇水区域名称		设计重现期 (a)
室外场地	居住小区	1~3
	车站、码头、机场的基地	2~5
屋面	一般性建筑物屋面	2~5
	重要公共建筑屋面	10

注：工业厂房屋面雨水排水设计重现期由生产工艺、重要程度等因素确定。

4.9.6 各种屋面、地面的雨水径流系数可按表 4.9.6 采用。

4.9.7 雨水汇水面积应按地面、屋面水平投影面积计算。高出屋面的侧墙，应附加其最大受雨面正投影的一半作为有效汇水面积计算。窗井、贴近高层建筑外墙的地下车库出入口坡道和高层建筑裙房屋面的雨水汇水面积，应附加其高出部分侧墙面积的二分之一。

4.9.8 建筑屋面雨水排水工程应设置溢流口、溢流堰、溢流管系等溢流设施。溢流排水不得危害建筑设施和行人安全。

4.9.9 一般建筑的重力流屋面雨水排水工程与溢流设施的总排水能力不应小于 10 年重现期的雨水量。重要公共建筑、高层建筑的屋面雨水排水工程与溢流设施的总排水能力不应小于 50 年重现期的雨水量。

4.9.10 建筑屋面雨水管道设计流态宜符合下列状态：

- 1 檐沟外排水宜按重力流设计。
- 2 长天沟外排水宜按压力流设计。
- 3 高层建筑屋面雨水排水宜按重力流设计。
- 4 工业厂房、库房、公共建筑的大型屋面雨水排水宜按压力流设计。

4.9.11 高层建筑裙房屋面的雨水应单独排放。

4.9.12 阳台排水系统应单独设置。阳台雨水立管底部应间接排水。

4.9.13 屋面雨水管道如按压力流设计时，同一系统的雨水斗宜在同一水平面上。

4.9.14 屋面排水系统应设置雨水斗。不同设计排水流态、排水特征的屋面雨水排水系统应选用相应的雨水斗。

4.9.15 雨水斗的设置位置应根据屋面汇水情况并结合建筑结构承载、管系数设等因素确定。

4.9.16 雨水斗的设计排水负荷应根据各种雨水斗的特性、并结合屋面排水条件等情况设计确定。

4.9.17 天沟布置应以伸缩缝、沉降缝、变形缝为分界。

4.9.18 天沟坡度不宜小于 0.003。

4.9.19 居住小区内雨水口的布置应根据地形、建筑物位置，沿道路布置，下列部位宜布置雨水口：

- 1 道路交汇处和路面最低点。
- 2 建筑物单元出入口与道路交界处。
- 3 建筑雨水落水管附近。
- 4 小区空地、绿地的低洼点。
- 5 地下坡道入口处（结合带格栅的排水沟一并处理）。

4.9.20 重力流屋面雨水排水管系的悬吊管应按非满流设计，其充满度不宜大于 0.8，管内流速不宜小于 0.75m/s。

4.9.21 重力流屋面雨水排水管系的埋地管可按满流排水设计，管内流速不宜小于

表 4.9.6 径流系数

屋面、地面种类	Ψ
屋面	0.9
混凝土和沥青路面	0.9
块石路面	0.6
级配碎石路面	0.45
干砖及碎石路面	0.40
非铺砌地面	0.30
公园绿地	0.15

注：各种汇水面积的综合径流系数应加权平均计算。

0.75m/s。

4.9.22 重力流屋面雨水排水立管的最大设计泄流量，应按表4.9.22确定。

表 4.9.22 重力流屋面雨水排水立管的泄流量

铸铁管		塑料管		钢管	
公称直径 (mm)	最大泄流量 (L/s)	公称外径×壁厚 (mm)	最大泄流量 (L/s)	公称外径×壁厚 (mm)	最大泄流量 (L/s)
75	5.46	75×2.3	5.71	108×4	11.77
100	11.77	90×3.2	9.22	133×4	21.34
		110×3.2	15.98		
125	21.34	125×3.2	22.92	159×4.5	34.69
		125×3.7	22.41	168×6	38.52
150	34.69	160×4.0	44.43	219×6	81.90
		160×4.7	43.34		
200	74.72	200×4.9	80.78	245×6	112.28
		200×5.9	78.53		
250	135.47	250×6.2	146.21	273×7	148.87
		250×7.3	142.63		
300	220.29	315×7.7	271.34	325×7	242.49
		315×9.2	264.15		

4.9.23 居住小区雨水管道宜按满管重力流设计，管内流速不宜小于 0.75m/s。

4.9.24 压力流屋面雨水排水管道应符合下列规定：

- 1 悬吊管与雨水斗出口的高差应大于 1.0m。
- 2 悬吊管设计流速不宜小于 1m/s，立管设计流速不宜大于 10m/s。
- 3 雨水排水管道总水头损失与流出水头之和不得大于雨水管进、出口的几何高差。
- 4 悬吊管水头损失不得大于 80kPa。
- 5 压力流排水管系各节点的上游不同支路的计算水头损失之差，在管径小于等于 DN75 时，不应大于 10kPa；在管径大于等于 DN100 时，不应大于 5kPa。
- 6 压力流排水管系出口应放大管径，其出口水流速度不宜大于 1.8m/s，如其出口水流速度大于 1.8m/s 时，应采取消能措施。

4.9.25 各种雨水管道的最小管径和横管的最小设计坡度宜按表 4.9.25 确定。

表 4.9.25 雨水管道的最小管径和横管的最小设计坡度

管 别	最小管径 (mm)	横管最小设计坡度	
		铸铁管、钢管	塑料管
建筑外墙雨水落水管	75 (75)	—	—
雨水排水立管	100 (110)	—	—
重力流排水悬吊管、埋地管	75 (75)	0.01	0.005

续表 4.9.25

管 别	最小管径 (mm)	横管最小设计坡度	
		铸铁管、钢管	塑料管
压力流屋面排水悬吊管	50 (50)	0.00	0.00
小区建筑物周围雨水接户管	200 (225)	0.005	0.003
小区道路下干管、支管	300 (315)	0.003	0.0015
13# 沟头的雨水口的连接管	200 (225)	0.01	0.01

注：表中铸铁管管径为公称直径，括号内数据为塑料管外径。

4.9.26 雨水排水管材选用应符合下列规定：

1 重力流排水系统多层建筑宜采用建筑排水塑料管，高层建筑宜采用承压塑料管、金属管。

2 压力流排水系统宜采用内壁较光滑的带内衬的承压排水铸铁管、承压塑料管和钢塑复合管等，其管材工作压力应大于建筑物净高度产生的静水压。用于压力流排水的塑料管，其管材抗环变形外压力应大于 0.15MPa。

3 小区雨水排水系统可选用埋地塑料管、混凝土管或钢筋混凝土管、铸铁管等。

4.9.27 建筑屋面各汇水范围内，雨水排水立管不宜少于 2 根。

4.9.28 重力流屋面雨水排水管系，悬吊管管径不得小于雨水斗连接管的管径，立管管径不得小于悬吊管的管径。

4.9.29 压力流屋面雨水排水管系，立管管径应经计算确定，可小于上游横管管径。

4.9.30 屋面雨水排水管的转向处宜做顺水连接。

4.9.31 屋面排水管系应根据管道直线长度、工作环境、选用管材等情况设置必要的伸缩装置。

4.9.32 重力流雨水排水系统中长度大于 15m 的雨水悬吊管，应设检查口，其间距不宜大于 20m，且应布置在便于维修操作处。

4.9.33 有埋地排出管的屋面雨水排出管系，立管底部应设清扫口。

4.9.34 雨水检查井的最大间距可按表 4.9.34 确定。

4.9.35 寒冷地区，雨水立管应布置在室内。

4.9.36 雨水管应牢固地固定在建筑物的承重结构上。

表 4.9.34 雨水检查井的最大间距

管径 (mm)	最大间距 (m)
150 (160)	20
200 ~ 300 (200 ~ 315)	30
400 (400)	40
≥ 500 (500)	50

注：括号内数据为塑料管外径。

5 热水及饮水供应

5.1 热水用水定额、水温和水质

5.1.1 热水用水定额根据卫生器具完善程度和地区条件,应按表 5.1.1-1 确定。

卫生器具的一次和小时热水用水量和水温应按表 5.1.1-2 确定。

表 5.1.1-1 热水用水定额

序号	建筑物名称	单位	最高日用水定额 (L)	使用时间 (h)
1	住宅 有自备热水供应和沐浴设备 有集中热水供应和沐浴设备	每人 每日	40 ~ 80 60 ~ 100	24
2	别墅	每人每日	70 ~ 110	24
3	单身职工宿舍、学生宿舍、招待所、培训中心、普通旅馆 设公用盥洗室 设公用盥洗室、淋浴室 设公用盥洗室、淋浴室、洗衣室 设单独卫生间、公用洗衣室	每人每日 每人每日 每人每日 每人每日	25 ~ 40 40 ~ 60 50 ~ 80 60 ~ 100	24 或定时供应
4	宾馆客房 旅客 员工	每床位每日 每人每日	120 ~ 160 40 ~ 50	24
5	医院住院部 设公用盥洗室 设公用盥洗室、淋浴室 设单独卫生间 医务人员 门诊部、诊疗所 疗养院、休养所住房部	每床位每日 每床位每日 每床位每日 每人每班 每病人每次 每床位每日	60 ~ 100 70 ~ 130 110 ~ 200 70 ~ 130 7 ~ 13 100 ~ 160	24 8 24
6	养老院	每床位每日	50 ~ 70	24
7	幼儿园、托儿所 有住宿 无住宿	每儿童每日 每儿童每日	20 ~ 40 10 ~ 15	24 10
8	公共浴室 淋浴 淋浴、浴盆 桑拿浴 (淋浴、按摩池)	每顾客每次 每顾客每次 每顾客每次	40 ~ 60 60 ~ 80 70 ~ 100	12
9	理发室、美容院	每顾客每次	10 ~ 15	12
10	洗衣房	每千克干衣	15 ~ 30	8
11	餐饮厅 营业餐厅 快餐店、职工及学生食堂 酒吧、咖啡厅、茶座、卡拉 OK 房	每顾客每次 每顾客每次 每顾客每次	15 ~ 20 7 ~ 10 3 ~ 8	10 ~ 12 11 18
12	办公楼	每人每班	5 ~ 10	8
13	健身中心	每人每次	15 ~ 25	12
14	体育场 (馆) 运动员淋浴	每人每次	25 ~ 35	4
15	会议厅	每座位每次	2 ~ 3	4

注: 1 热水温度按 60℃ 计。

2 表内所列用水定额均已包括在本规范表 3.1.9、3.1.10 中。

3 本表以 60℃ 热水水温为计算温度, 卫生器具的使用水温见表 5.1.1-2。

表 5.1.1-2 卫生器具的一次和小时热水用水定额及水温

序号	卫生器具名称	一次用水量 (L)	小时用水量 (L)	使用水温 (℃)
1	住宅、旅馆、别墅、宾馆			
	带有淋浴器的浴盆	150	300	40
	无淋浴器的浴盆	125	250	40
	淋浴器	70 ~ 100	140 ~ 200	37 ~ 40
	洗脸盆、盥洗槽水嘴	3	30	30
	洗涤盆 (池)	—	180	50
2	集体宿舍、招待所、培训中心淋浴器			
	有淋浴小间	70 ~ 100	210 ~ 300	37 ~ 40
	无淋浴小间	—	450	37 ~ 40
	盥洗槽水嘴	3 ~ 5	50 ~ 80	30
3	餐饮业			
	洗涤盆 (池)	—	250	50
	洗脸盆：工作人员用	3	60	30
	顾客用	—	120	30
	淋浴器	40	400	37 ~ 40
4	幼儿园、托儿所			
	浴盆：幼儿园	100	400	35
	托儿所	30	120	35
	淋浴器：幼儿园	30	180	35
	托儿所	15	90	35
	盥洗槽水嘴	15	25	30
	洗涤盆 (池)	—	180	50
5	医院、疗养院、休养所			
	洗手盆	—	15 ~ 25	35
	洗涤盆 (池)	—	300	50
	浴盆	125 ~ 150	250 ~ 300	40
6	公共浴室			
	浴盆	125	250	40
	淋浴器：有淋浴小间	100 ~ 150	200 ~ 300	37 ~ 40
	无淋浴小间	—	450 ~ 540	37 ~ 40
	洗脸盆	5	50 ~ 80	35
7	办公楼 洗手盆	—	50 ~ 100	35
8	理发室 美容院 洗脸盆	—	35	35
9	实验室			
	洗脸盆	—	60	50
	洗手盆	—	15 ~ 25	30
10	剧场			
	淋浴器	60	200 ~ 400	37 ~ 40
	演员用洗脸盆	5	80	35
11	体育场馆 淋浴器	30	300	35

续表 5.1.1-2

序号	卫生器具名称	一次用水量 (L)	小时用水量 (L)	使用水温 (℃)
12	工业企业生活间			
	淋浴器：一般车间	40	360 ~ 540	37 ~ 40
	脏车间	60	180 ~ 480	40
	洗脸盆或盥洗槽水嘴：			
	一般车间	3	90 ~ 120	30
	脏车间	5	100 ~ 150	35
13	净身器	10 ~ 15	120 ~ 180	30

注：一般车间指现行《工业企业设计卫生标准》中规定的 3、4 级卫生特征的车间，脏车间指该标准中规定的 1、2 级卫生特征的车间。

5.1.2 生活热水水质的卫生指标，应符合现行的《生活饮用水卫生标准》的要求。

5.1.3 集中热水供应系统的原水的水处理，应根据水质、水量、水温、水加热设备的构造、使用要求等因素经技术经济比较按下列确定。

1 洗衣房日用热水量（按 60℃计）大于或等于 10m³ 且原水总硬度（以碳酸钙计）大于 300mg/L 时，应进行水质软化处理；原水总硬度（以碳酸钙计）为 150 ~ 300mg/L 时，宜进行水质软化处理。

2 其他生活日用热水量（按 60℃计）大于或等于 10m³ 且原水总硬度（以碳酸钙计）大于 300mg/L 时，宜进行水质软化或稳定处理。

3 经软化处理后的水质总硬度宜为：洗衣房用水：50 ~ 100mg/L；其他用水：75 ~ 150mg/L。

4 水质稳定处理应根据水的硬度、适用流速、温度、作用时间或有效长度及工作电压等选择合适的物理处理或化学稳定剂处理方法。

5 系统对溶解氧控制要求较高时，宜采取除氧措施。

5.1.4 冷水的计算温度，应以当地最冷月平均水温资料确定。当无水温资料时，可按表 5.1.4 采用。

表 5.1.4 冷水计算温度

地 区	地面水温度 (℃)	地下水温度 (℃)
黑龙江、吉林、内蒙古的全部，辽宁的大部分，河北、山西、陕西偏北部分，宁夏偏东部分	4	6 ~ 10
北京、天津、山东全部，河北、山西、陕西的大部分，河北北部，甘肃、宁夏、辽宁的南部，青海偏东和江苏偏北的一小部分	4	10 ~ 15
上海、浙江全部，江西、安徽、江苏的大部分，福建北部，湖南、湖北东部，河南南部	5	15 ~ 20
广东、台湾全部，广西大部分，福建、云南的南部	10 ~ 15	20
重庆、贵州全部，四川、云南的大部分，湖南、湖北的西部，陕西和甘肃秦岭以南地区，广西偏北的一小部分	7	15 ~ 20

5.1.5 直接供应热水的热水锅炉、热水机组或水加热器出口的最高水温和配水点的最低

水温可按表 5.1.5 采用。

**表 5.1.5 直接供应热水的热水锅炉、热水机组或水加热器出口的
最高水温和配水点的最低水温**

水质处理情况	热水锅炉、热水机组或水加 热器出口的最高水温 (℃)	配水点的最低水温 (℃)
原水水质无需软化处理, 原水水质需水质处理且 有水质处理	75	50
原水水质需水质处理但未进行水质处理	60	50

注: 当热水供应系统只供淋浴和盥洗用水, 不供洗涤盆(池)洗涤用水时, 配水点最低水温可不低于 40℃。

5.2 热水供应系统选择

5.2.1 热水供应系统的选择, 应根据使用要求、耗热量及用水点分布情况, 结合热源条件确定。

5.2.2 集中热水供应系统的热源, 宜首先利用工业余热、废热、地热和太阳能。

注: 1 利用废热锅炉制备热媒时, 引入其内的废气、烟气温度不宜低于 400℃。

2 以太阳能为热源的集中热水供应系统, 宜附设一套辅助加热装置。

3 以地热为热源时, 应按地热水的水温、水质和水压, 采取相应的技术措施。

5.2.3 当没有条件利用工业余热、废热或太阳能时, 宜优先采用能保证全年供热的热力管网作为集中热水供应的热源。

5.2.4 当区域性锅炉房或附近的锅炉房能充分供给蒸汽或高温水时, 宜采用蒸汽或高温水作集中热水供应系统的热媒。

5.2.5 当无 5.2.2、5.2.3、5.2.4 条所述热源可利用时, 可设燃油、燃气热水机组或电蓄热设备等供给集中热水供应系统的热源或直接供给热水。

5.2.6 局部热水供应系统的热源宜采用太阳能及电能、燃气、蒸汽等。

5.2.7 升温后的冷却水, 其水质如符合本规范第 5.1.2 条规定的要求时, 可作为生活用热水。

5.2.8 利用废热(废气、烟气、高温无毒废液等)作为热媒时, 应采取下列措施:

1 加热设备应防腐, 其构造便于清理水垢和杂物;

2 防止热媒管道渗漏而污染水质;

3 消除废气压力波动和除油。

5.2.9 采用蒸汽直接通入水中或采取汽水混合设备的加热方式时, 宜用于开式热水供应系统, 并应符合下列要求:

1 蒸汽中不含油质及有害物质。

2 加热时应采用消声混合器, 所产生的噪声应符合现行的《城市区域环境噪声标准》的要求。

3 当不回收凝结水经技术经济比较合理时。

4 应采取防止热水倒流至蒸汽管道的措施。

5.2.10 集中热水供应系统应设热水回水管道, 其设置应符合下列要求:

1 热水供应系统应保证干管和立管中的热水循环;

2 要求随时取得不低于规定温度的热水的建筑物,应保证支管中的热水循环,或有保证支管中热水温度的措施。

5.2.11 循环管道应采用同程布置的方式,并设循环泵,采取机械循环。

5.2.12 设有集中热水供应系统的建筑物中,用水量较大的浴室、洗衣房、厨房等,宜设单独的热水管网。热水为定时供应,且个别用户对热水供应时间有特殊要求时,宜设置单独的热水管网或局部加热设备。

5.2.13 高层建筑热水系统的分区,应遵循如下原则:

1 与给水系统的分区应一致,各区水加热器、贮水罐的进水均应由同区的给水系统专管供应;当不能满足时,应采取保证系统冷、热水压力平衡的措施。

2 当采用减压阀分区时,除满足本规范 3.4.10 条的要求外,尚应保证各分区热水的循环。

5.2.14 当给水管道的的水压变化较大且用水点要求水压稳定时,宜采用开式热水供应系统或采取稳压措施。

5.2.15 当卫生设备设有冷热水混合器或混合龙头时,冷、热水供应系统在配水点处应有相近的水压。

5.2.16 公共浴室淋浴器出水水温应稳定,并宜采用下列措施:

1 采用开式热水供应系统。

2 给水额定流量较大的用水设备的管道,应与淋浴配水管道分开。

3 多于 3 个淋浴器的配水管道,宜布置成环形。

4 成组淋浴器的配水管的沿程水头损失,当淋浴器少于或等于 6 个时,可采用每米不大于 300Pa。当淋浴器多于 6 个时,可采用每米不大于 350Pa。配水管不宜变径,且其最小管径不得小于 25mm。

5 工业企业生活间和学校的淋浴室,宜采用单管热水供应系统。单管热水供应系统应有热水水温稳定的技术措施。

注:公共浴室不宜采用公用浴池沐浴的方式,如必须采用,则应设循环水处理系统及消毒设备。

5.3 耗热量、热水量和加热设备供热量的计算

5.3.1 设计小时耗热量的计算:

1 设有集中热水供应系统的居住小区的设计小时耗热量,当公共建筑的最大用水时段与住宅的最大用水时段一致时,应按两者的设计小时耗热量叠加计算,当公共建筑的最大用水时段与住宅的最大用水时段不一致时,应按住宅的设计小时耗热量加公共建筑的平均小时耗热量叠加计算。

2 全日供应热水的住宅、别墅、招待所、培训中心、旅馆、宾馆的客房(不含员工)、医院住院部、养老院、幼儿园、托儿所(有住宿)等建筑的集中热水供应系统的设计小时耗热量应按式计算:

$$Q_h = K_h \frac{mq_r C(t_r - t_l) \rho_r}{86400} \quad (5.3.1-1)$$

式中 Q_h ——设计小时耗热量(W);

m ——用水计算单位数(人数或床位数);

q_r ——热水用水定额 (L/人·d 或 L/床·d) 应按本规范表 5.1.1-1 采用;

C ——水的比热, $C = 4187$ (J/kg·℃);

t_r ——热水温度, $t_r = 60$ (℃);

t_l ——冷水温度, 按本规范表 5.1.4 选用;

ρ_r ——热水密度 (kg/L);

K_h ——小时变化系数, 可按表 5.3.1-1 ~ 表 5.3.1-3 采用。

表 5.3.1-1 住宅、别墅的热水小时变化系数 K_h 值

居住人数 m	≤ 100	150	200	250	300	500	1000	3000	≥ 6000
K_h	5.12	4.49	4.13	3.88	3.70	3.28	2.86	2.48	2.34

表 5.3.1-2 旅馆的热水小时变化系数 K_h 值

床位数 m	≤ 150	300	450	600	900	≥ 1200
K_h	6.84	5.61	4.97	4.58	4.19	3.90

表 5.3.1-3 医院的热水小时变化系数 K_h 值

床位数 m	≤ 50	75	100	200	300	500	≥ 1000
K_h	4.55	3.78	3.54	2.93	2.60	2.23	1.95

注: 招待所、培训中心、宾馆的客房 (不含员工)、养老院、幼儿园、托儿所 (有住宿) 等建筑的 K_h 可参照表 5.3.1-2 选用; 办公楼的 K_h 见表 3.1.10。

3 定时供应热水的住宅、旅馆、医院及工业企业生活间、公共浴室、学校、剧院、体育馆 (场) 等建筑的集中热水供应系统的设计小时耗热量应按下式计算:

$$Q_h = \sum \frac{q_h (t_r - t_l) \rho_r N_o b C}{3600} \quad (5.3.1-2)$$

式中 Q_h ——设计小时耗热量 (W);

q_h ——卫生器具热水的小时用水定额 (L/h), 应按本规范表 5.1.1-2 采用;

C ——水的比热, $C = 4187$ (J/kg·℃);

t_r ——热水温度 (℃), 按本规范表 5.1.1-2 采用;

t_l ——冷水温度 (℃), 按本规范表 5.1.4 采用;

ρ_r ——热水密度 (kg/L);

N_o ——同类型卫生器具数;

b ——卫生器具的同时使用百分数: 住宅、旅馆、医院、疗养院病房, 卫生间内浴盆或淋浴器可按 70% ~ 100% 计, 其他器具不计, 但定时连续供水时间应不小于 2h。工业企业生活间、公共浴室、学校、剧院、体育馆 (场) 等的浴室内的淋浴器和洗脸盆均按 100% 计。住宅一户带多个卫生间时, 只按一个卫生间计算。

4 具有多个不同使用热水部门的单一建筑或具有多种使用功能的综合性建筑, 当其热水由同一热水供应系统供应时, 设计小时耗热量, 可按同一时间内出现用水高峰的主要用水部门的设计小时耗热量加其他用水部门的平均小时耗热量计算。

5.3.2 设计小时热水量可按式计算:

$$q_{rh} = \frac{Q_h}{1.163 (t_r - t_l) \rho_r} \quad (5.3.2)$$

式中 q_{rh} ——设计小时热水量 (L/h);

Q_h ——设计小时耗热量 (W);

t_r ——设计热水温度 (°C);

t_l ——设计冷水温度 (°C);

ρ_r ——热水密度 (kg/L)。

5.3.3 集中热水供应系统中, 锅炉、水加热设备的设计小时供热量应根据日热水用量小时变化曲线、加热方式及锅炉、水加热设备的工作制度经积分曲线计算确定。当无条件时, 可按下列原则确定:

1 容积式水加热器或贮热容积与其相当的水加热器、热水机组, 按下式计算:

$$Q_g = Q_h - 1.163 \frac{\eta V_r}{T} (t_r - t_l) \rho_r \quad (5.3.3)$$

式中 Q_g ——容积式水加热器的设计小时供热量 (W);

Q_h ——设计小时耗热量 (W);

η ——有效贮热容积系数; 容积式水加热器 $\eta = 0.75$, 导流型容积式水加热器 $\eta = 0.85$;

V_r ——总贮热容积 (L);

T ——设计小时耗热量持续时间 (h), $T = 2 \sim 4h$;

t_r ——热水温度 (°C), 按设计水加热器出水温度或贮水温度计算;

t_l ——冷水温度 (°C), 宜按表 5.1.4 采用;

ρ_r ——热水密度 (kg/L)。

2 半容积式水加热器或贮热容积与其相当的水加热器、热水机组的供热量按设计小时耗热量计算。

3 半即热式、快速式水加热器及其他无贮热容积的水加热设备的供热量按设计秒流量计算。

5.4 水的加热和贮存

5.4.1 加热设备应根据使用特点、耗热量、热源、维护管理及卫生防菌等因素选择, 并符合下列要求:

- 1 热效率高, 换热效果好、节能、节省设备用房;
- 2 生活热水侧阻力损失小, 有利于整个系统冷、热水压力的平衡;
- 3 安全可靠、构造简单、操作维修方便。

5.4.2 选用水加热设备应遵循下列原则：

1 当采用自备热源时，宜采用直接供应热水的燃气、燃油等燃料的热水机组，亦可采用间接供应热水的自带换热器的热水机组或外配容积式、半容积式水加热器的热水机组。

2 热水机组除满足 5.4.1 条的要求之外，还应具备燃料燃烧完全、消烟除尘、机组水套通大气、自动控制水温、火焰传感、自动报警等功能。

3 当采用蒸汽、高温水为热媒时，应结合用水的均匀性、给水水质硬度、热媒的供应能力、系统对冷热水压力平衡稳定的要求及设备所带温控安全装置的灵敏度、可靠性等经综合技术经济比较后选择间接水加热设备。

4 当热源为太阳能时，宜采用热管或真空管太阳能热水器。

5 在电源供应充沛的地方可采用电热水器。

5.4.3 医院热水供应系统的锅炉或水加热器不得少于 2 台，其他建筑的热水供应系统的水加热设备不宜少于 2 台，一台检修时，其余各台的总供热能力不得小于设计小时耗热量的 50%。

医院建筑不得采用有滞水区的容积式水加热器。

5.4.4 选用局部热水供应设备时，应符合下列要求：

1 选用设备应综合考虑热源条件、建筑物性质、安装位置、安全要求及设备性能特点等因素。

2 需同时供给多个卫生器具或设备热水时，宜选用带贮热容积的加热设备。

3 当地太阳能资源充足时，宜选用太阳能热水器或太阳能辅以电加热的热水器。

4 热水器不应安装在易燃物堆放或对燃气管、表或电气设备产生影响及有腐蚀性气体和灰尘多的地方。

5.4.5 燃气热水器、电热水器必须带有保证使用安全的装置。严禁在浴室内安装直接排气式燃气热水器等在使用空间内积聚有害气体的加热设备。

5.4.6 表面式水加热器的加热面积，应按下式计算：

$$F_{jr} = \frac{C_r Q_z}{\epsilon K \Delta t_j} \quad (5.4.6)$$

式中 F_{jr} ——表面式水加热器的加热面积 (m^2)；

Q_z ——制备热水所需的热量 (W)；

K ——传热系数 ($\text{W}/\text{m}^2 \cdot ^\circ\text{C}$)；

ϵ ——由于水垢和热媒分布不均匀影响传热效率的系数，一般采用 0.6~0.8；

Δt_j ——热媒与被加热水的计算温度差 ($^\circ\text{C}$)，按本规范第 5.4.7 条的规定确定；

C_r ——热水供应系统的热损失系数，宜采用 1.1~1.15。

5.4.7 水加热器热媒与被加热水的计算温度差，应按下式计算：

1 容积式水加热器、半容积式水加热器：

$$\Delta t_j = \frac{t_{mc} + t_{mz}}{2} - \frac{t_c + t_z}{2} \quad (5.4.7-1)$$

式中 Δt_j ——计算温度差 ($^\circ\text{C}$)；

t_{mc} 、 t_{mz} ——热媒的初温和终温 ($^\circ\text{C}$)；

t_c 、 t_z ——被加热水的初温和终温 (°C)。

2 快速式水加热器、半即热式水加热器:

$$\Delta t_j = \frac{\Delta t_{\max} - \Delta t_{\min}}{\ln \frac{\Delta t_{\max}}{\Delta t_{\min}}} \quad (5.4.7-2)$$

式中 Δt_j ——计算温度差 (°C);

$\Delta t_{\max}$ ——热媒与被加热水在水加热器一端的最大温度差 (°C);

$\Delta t_{\min}$ ——热媒与被加热水在水加热器另一端的最小温度差 (°C)。

5.4.8 热媒的计算温度,应符合下列规定:

1 热媒为压力大于 70kPa 的饱和蒸汽时,其计算温度应按饱和蒸汽温度计算,压力小于及等于 70kPa 时,应按 100°C 计算。

2 热媒为热力管网的热水时,热媒的计算温度应按热力管网供回水的最低温度计算,但热媒的初温与被加热水的终温的温度差,不得小于 10°C。

5.4.9 容积式水加热器或加热水箱的容积附加系数应符合下列规定:

1 当冷水从下部进入、热水从上部送出,其计算容积宜附加 20% ~ 25%。

2 当采用导流型容积式水加热器时,其计算容积应附加 10% ~ 15%。

3 当采用半容积式水加热器时,或带有强制罐内水循环装置的容积式水加热器时,其计算容积可不附加。

5.4.10 集中热水供应系统的贮水器容积应根据日用热水小时变化曲线及锅炉、水加热器的工作制度和供热能力以及自动温度控制装置等因素按积分曲线计算确定。

1 容积式水加热器或加热水箱、半容积式水加热器的贮热量不得小于表 5.4.10 的要求。

表 5.4.10 水加热器的贮热量

加 热 设 备	以蒸汽或 95°C 以上的高温水为热媒时		以 ≤95°C 低温水为热媒时	
	工业企业淋浴室	其他建筑物	工业企业淋浴室	其他建筑物
容积式水加热器或加热水箱	≥ 30min Q_h	≥ 45min Q_h	≥ 60min Q_h	≥ 90min Q_h
导流型容积式水加热器	≥ 20min Q_h	≥ 30min Q_h	≥ 30min Q_h	≥ 40min Q_h
半容积式水加热器	≥ 15min Q_h	≥ 15min Q_h	≥ 15min Q_h	≥ 20min Q_h

注: 1 热水机组所配贮热器,其贮热量宜根据热媒供应情况,按导流型容积式水加热器或半容积式水加热器确定。

2 表中 Q_h 为设计小时耗热量 (W)。

2 半即热式、快速式水加热器当热媒按设计秒流量供应,且有完善可靠的温度自动控制装置时,可不设贮水器。当其不具备上述条件时,应设贮水器,贮热量宜根据热媒供应情况按导流型容积式水加热器或半容积式水加热器确定。

5.4.11 在设有高位加热贮热水箱的连续加热的热水供应系统中,应设置冷水补给水箱。

注: 当有冷水箱可补给热水供应系统冷水时,可不另设冷水补给水箱。

5.4.12 冷水补给水箱的设置高度(以水箱底计算)应保证最不利处的配水点所需水压。

5.4.13 冷水补给水管的设置,应符合下列要求:

- 1 冷水补给水管的管径，应按热水供应系统的设计秒流量确定。
- 2 冷水补给水管除供给加热设备、加热水箱、热水贮水器外，不宜再供其他用水。
- 3 有第一循环的热水供应系统，冷水补给水管应接入热水贮水罐，不得接入第一循环的回水管、锅炉或热水机组。

5.4.14 热水箱应加盖，并应设溢流管、泄水管和引出室外的通气管。热水箱溢流水位超出冷水补水箱的水位高度，应按热水膨胀量计算。泄水管、溢流管不得与排水管道直接连接。

5.4.15 水加热设备和贮热设备罐体应根据水质情况及使用要求采用耐腐蚀材料制作或在钢制罐体内表面做衬、涂、镀防腐材料处理。

5.4.16 水加热设备的布置，应符合下列要求：

- 1 容积式、导流型容积式、半容积式水加热器的一侧应有净宽不小于 0.7m 的通道，前端应留有抽出加热盘管的位置。
- 2 水加热器上部附件的最高点至建筑结构最低点的净距，应满足检修的要求，但不得小于 0.2m，房间净高不得低于 2.2m。

5.4.17 热水机组的布置应符合下列要求：

- 1 热水机组机房宜与其他建筑物分离独立设置。当机房设在建筑物内时，不应设置在人员密集场所的上、下与贴邻，并应设对外的安全出口。
- 2 机房的布置应满足设备的安装、运行和检修要求，其前方应留不少于机组长度 2/3 的空间，后方应留 0.8 ~ 1.5m 的空间，两侧通道宽度应为机组宽度，且不应小于 1.0m。机组最上部部件（烟囱除外）至机房顶板梁底净距不宜小于 0.8m。
- 3 机房与热水机组配套的日用油箱、贮油罐等的布置和供油、供气管道的敷设应符合有关消防、安全的要求。

5.4.18 设置锅炉、热水机组、水加热器、贮热器的房间，应便于泄水，防止污水倒灌，并应有良好的通风和照明。

5.4.19 在设有膨胀管的开式热水供应系统中，膨胀管的设置应符合下列要求：

- 1 当热水系统由生活饮用高位水箱补水时，可将膨胀管引至同一建筑物的除生活饮用水箱以外的其他高位水箱的上空，其高度按 5.4.19-1 式计算：

$$h = H \left(\frac{\rho_l}{\rho_r} - 1 \right) \quad (5.4.19-1)$$

式中 h ——膨胀管高出生活饮用高位水箱水面的垂直高度 (m)；
 H ——锅炉、水加热器底部至生活饮用高位水箱水面的高度 (m)；
 ρ_l ——冷水密度 (kg/m^3)；
 ρ_r ——热水密度 (kg/m^3)。

膨胀管出口离接入水箱水面的高度不少于 100mm。

- 2 热水供水系统上如设置膨胀水箱，其容积应按 5.4.19-2 式计算；膨胀水箱水面高出系统冷水补给水箱水面的高度按 5.4.19-3 式计算。

$$V_p = 0.0006 \Delta t V_s \quad (5.4.19-2)$$

式中 V_p ——膨胀水箱有效容积 (L)；

Δt ——系统内水的最大温差 (°C);

V_s ——系统内的水容量 (L)。

$$h = H \left(\frac{\rho_h}{\rho_r} - 1 \right) \quad (5.4.19-3)$$

式中 h ——膨胀水箱水面高出系统冷水补给水箱水面的垂直高度(m);

H ——锅炉、水加热器底部至系统冷水补给水箱水面的高度(m);

ρ_h ——热水回水密度 (kg/m^3);

ρ_r ——热水供水密度 (kg/m^3)。

3 膨胀管如有冻结可能时,应采取保温措施。

4 膨胀管的最小管径按表 5.4.19 确定。

表 5.4.19 膨胀管的最小管径

锅炉或水加热器的传热面积 (m^2)	< 10	≥ 10 且 < 15	≥ 15 且 < 20	≥ 20
膨胀管最小管径 (mm)	25	32	40	50

注:对多台锅炉或水加热器,宜分设膨胀管。

5.4.20 膨胀管上严禁装设阀门。

5.4.21 在闭式热水供应系统中,应设置压力式膨胀罐、泄压阀,并符合下列要求:

1 日用热水量小于等于 10m^3 的热水供应系统可采用泄压阀泄压的措施。

2 日用热水量大于 10m^3 的热水供应系统应设置压力式膨胀罐。膨胀罐的总容积按 5.4.21 式计算。

$$V_e = \frac{(\rho_f - \rho_r) P_2}{(P_2 - P_1) \rho_r} V_s \quad (5.4.21)$$

式中 V_e ——膨胀罐的总容积 (m^3);

ρ_f ——加热前加热、贮热设备内水的密度 (kg/m^3);

当只有一台加热设备且为定时供应热水的系统宜按冷水温度确定,有多台加热设备的集中热水供应系统宜按热水回水温度确定。

ρ_r ——热水密度 (kg/m^3);

P_1 ——膨胀罐处管内水压力 (MPa, 绝对压力);为管内工作压力 + 0.1 (MPa);

P_2 ——膨胀罐处管内最大允许压力 (MPa, 绝对压力),其数值可取 $1.05 P_1$;

V_s ——系统内热水总容积 (m^3)。

3 膨胀罐宜设置在加热设备的冷水进水管或热水回水管上。

5.5 管网计算

5.5.1 设有小区集中热水供应系统的居住小区室外热水干管的设计流量可按 3.6.1 条的规定计算确定。

建筑物的热水引入管可按该建筑物相应热水供水系统总干管的设计秒流量确定。

5.5.2 建筑物内热水供水管网的设计秒流量可分别按本规范 3.6.4 条、3.6.5 条和 3.6.6 条

计算。

5.5.3 卫生器具热水给水额定流量、当量、支管管径和最低工作压力，应符合本规范 3.1.14 条的规定。

5.5.4 热水管网的水头损失计算应遵守下列规定：

1 单位长度水头损失，应按本规范 3.6.10 条确定，但管道的计算内径 d_j 应考虑结垢和腐蚀引起过水面缩小的因素。

2 局部水头损失，可按本规范 3.6.11 条的规定计算。

5.5.5 全日供应热水系统的热水循环流量，应按下式计算：

$$q_x = \frac{Q_s}{1.163\Delta t} \quad (5.5.5)$$

式中 q_x ——全日供应热水的循环流量 (L/h)；

Q_s ——配水管道的热损失 (W)，经计算确定，一般采用设计小时耗热量的 3% ~ 5%；

Δt ——配水管道的热水温度差 (°C)，按系统大小确定，一般取 5 ~ 10°C。

5.5.6 定时热水供应系统的热水循环流量可按循环管网中的水每小时循环 2 ~ 4 次计算。

5.5.7 热水供应系统中，锅炉或水加热器的出水温度与配水点的最低水温的温度差，不得大于 10°C。

5.5.8 热水管道的流速，宜按表 5.5.8 选用。

5.5.9 设循环系统的热水供应系统的热水回水管管径，应按管路的循环流量经水力计算确定。

表 5.5.8 热水管道的流速

公称直径 (mm)	15 ~ 20	25 ~ 40	≥ 50
流速 (m/s)	≤ 0.8	≤ 1.0	≤ 1.2

5.5.10 机械循环的热水供应系统，其循环水泵的确定应遵守下列规定：

1 水泵的出水量应为循环流量。

2 水泵的扬程应按下式计算：

$$H_b = h_p + h_x \quad (5.5.10)$$

式中 H_b ——循环水泵的扬程 (kPa)；

h_p ——循环水量通过配水管网的水头损失 (kPa)；

h_x ——循环水量通过回水管网的水头损失 (kPa)。

注：当采用半即热式水加热器或快速水加热器时，水泵扬程尚应计算水加热器的水头损失。

3 循环水泵应选用热水泵，水泵壳体承受的工作压力不得小于其所承受的静水压力加水泵扬程。

4 循环水泵宜设备用泵，交替运行。

5 全日制热水供应系统的循环水泵应由泵前回水管的温度控制开停。

5.5.11 热水加压泵的布置应符合本规范 3.8 节的要求。

5.5.12 第一循环管的自然压力值，应按下式计算：

$$H_{\text{自}} = 10 \cdot \Delta h (\rho_h - \rho_r) \quad (5.5.12)$$

式中 $H_{\text{自}}$ ——第一循环管的自然压力值 (Pa)；

Δh ——锅炉或水加热器中心与贮水器中心的标高差 (m);

ρ_h ——贮水器回水的密度 (kg/m^3);

ρ_r ——锅炉或水加热器出水的热水密度 (kg/m^3)。

5.6 管材、附件和管道敷设

5.6.1 热水系统采用的管材和管件,应符合现行产品标准的要求。管道的工作压力和工作温度不得大于产品标准标定的允许工作压力和工作温度。

5.6.2 热水管道应选用耐腐蚀和安装连接方便可靠的管材,可采用薄壁铜管、薄壁不锈钢管、塑料热水管、塑料和金属复合热水管等。

当采用塑料热水管或塑料和金属复合热水管材时应符合下列要求:

- 1 管道的工作压力应按相应温度下的许用工作压力选择;
- 2 设备机房内的管道不应采用塑料热水管。

5.6.3 热水管道系统,应有补偿管道热胀冷缩的措施。

5.6.4 上行下给式系统配水干管最高点应设排气装置,下行上给配水系统,可利用最高配水点放气;系统最低点应设泄水装置。

5.6.5 下行上给式系统设有循环管道时,其回水立管可在最高配水点以下(约 0.5m)与配水立管连接。上行下给式系统可将循环管道与各立管连接。

5.6.6 热水系统上各类阀门的材质及阀型应符合本规范 3.4.4 条、3.4.5 条、3.4.7 条、3.4.9 条、3.4.10 条的规定。

5.6.7 热水管网应在下列管段上装设阀门:

- 1 与配水、回水干管连接的分干管;
- 2 配水立管和回水立管;
- 3 从立管接出的支管;
- 4 3 个及 3 个以上配水点的配水支管;
- 5 与水加热设备、水处理设备及温度、压力等控制阀件连接处的管段上按其安装要求配置阀门。

5.6.8 热水管网上在下列管段上,应装止回阀:

- 1 水加热器或贮水罐的冷水供水管;
- 2 机械循环的第二循环回水管;
- 3 冷热水混水器的冷、热水供水管。

5.6.9 水加热设备的出水温度应根据其有无贮热调节容积分别采用不同温级精度要求的自动温度控制装置。

5.6.10 水加热设备的上部、热媒进出口管上,贮热水罐和冷热水混合器上应装温度计、压力表;热水循环的进水管上应装温度计及控制循环泵开停的温度传感器;热水箱应装温度计、水位计;压力容器设备应装安全阀,安全阀的接管直径应经计算确定,并应符合锅炉及压力容器的有关规定,安全阀的泄水管应引至安全处且在泄水管上不得装设阀门。

5.6.11 当需计量热水总用水量时,可在水加热设备的冷水供水管上装冷水表,对成组和

个别用水点可在专供支管上装设热水水表。有集中供应热水的住宅应装设分户热水水表。水表的选型、计算及设置应符合本规范 3.4.17 条、3.4.18 条、3.4.19 条的规定。

5.6.12 热水横管的敷设坡度不宜小于 0.003。

5.6.13 塑料热水管宜暗设，明设时立管宜布置在不受撞击处，如不能避免时，应在管外加保护措施。

5.6.14 热水锅炉、热水机组、水加热设备、贮水器、分（集）水器、热水输（配）水、循环回水干（立）管应做保温，保温层的厚度经计算确定。

5.6.15 热水管穿越建筑物、楼板和基础处应加套管，穿越屋面及地下室外墙时应加防水套管。

5.6.16 热水管道的敷设还应按本规范 3.5 节中有关条款执行。

5.6.17 用蒸汽作热媒间接加热的水加热器、开水器的凝结水回水管上应每台设备设疏水器，当水加热器的换热能确保凝结水回水温度小于等于 80℃ 时，可不装疏水器。蒸汽立管最低处、蒸汽管下凹处的下部宜设疏水器。

5.6.18 疏水器口径应经计算确定，其前应装过滤器，其旁不宜附设旁通阀。

5.7 饮 水 供 应

5.7.1 饮水定额及小时变化系数，根据建筑物的性质和地区的条件，应按表 5.7.1 确定。

表 5.7.1 饮水定额及小时变化系数

建筑物名称	单位	饮水定额 (L)	K_h
热车间	每人每班	3~5	1.5
一般车间	每人每班	2~4	1.5
工厂生活间	每人每班	1~2	1.5
办公楼	每人每班	1~2	1.5
集体宿舍	每人每日	1~2	1.5
教学楼	每学生每日	1~2	2.0
医院	每病床每日	2~3	1.5
影剧院	每观众每场	0.2	1.0
招待所、旅馆	每客人每日	2~3	1.5
体育馆（场）	每观众每场	0.2	1.0

注：小时变化系数是指饮水供应时间内的变化系数。

5.7.2 居住小区、住宅、别墅等建筑设有饮用净水供应系统时，饮水定额宜为 4~7L/人·d，小时变化系数宜为 6。

5.7.3 饮用净水系统应满足下列要求：

1 饮用净水宜以市政给水为原水，经过深度处理方法制备而成，其水质应符合现行的《饮用净水水质标准》的要求。

2 饮用净水水嘴额定流量宜为 0.04L/s，最低工作压力为 0.03MPa。

- 3 饮用净水宜采用调速泵组直接供水的方式。
- 4 高层建筑饮用净水系统应竖向分区,各分区最低处配水点的静水压不宜大于 0.35MPa,且不得大于 0.45MPa。
- 5 饮用净水应设循环管道,循环管网内水的停留时间不宜超过 6h。从立管接至配水水嘴的支管管段长度应尽可能短。
- 6 饮用净水系统配水管的设计秒流量应按下列公式计算:

$$q_g = q_o m \quad (5.7.3)$$

式中 q_g ——计算管段的设计秒流量 (L/s);
 q_o ——饮水水嘴额定流量,取 0.04 (L/s);
 m ——计算管段上同时使用饮水水嘴的个数。按附录 D 确定。

- 7 管道流速应按本规范 5.5.8 条执行。
 - 8 饮用净水的水头损失,应按本规范 3.6.10 条、3.6.11 条计算。
- 5.7.4 开水供应应满足下列要求:
- 1 开水计算温度应按 100℃ 计算,冷水计算温度应符合 5.1.4 条的规定。
 - 2 开水器的通气管应引至室外。
 - 3 配水水嘴宜为旋塞。
 - 4 开水器应装设温度计和水位计,开水锅炉应装设温度计,必要时还应装设沸水箱或安全阀。

- 5.7.5 中小学校、体育场(馆)等公共建筑设饮水器时,应符合下列要求:
- 1 以温水或自来水为原水的饮水,应进行过滤和消毒处理。
 - 2 应设循环管道,循环回水应经消毒处理。
 - 3 饮水器的喷嘴应倾斜安装并设有防护装置,喷嘴孔的高度应保证排水管堵塞时不被淹没。
 - 4 应使同组喷嘴压力一致。
 - 5 饮水器应采用不锈钢、铜镀铬或瓷质、搪瓷制品,其表面应光洁易于清洗。

5.7.6 饮水管道应选用耐腐蚀、内表面光滑、符合食品级卫生要求的薄壁不锈钢管、薄壁铜管、优质塑料管。开水管道应选用许用工作温度大于 100℃ 的金属管材。

5.7.7 阀门、水表、管道连接件、密封材料、配水水嘴等选用材质均应符合食品级卫生要求,并与管材匹配。

5.7.8 饮水供应点的设置,应符合下列要求:

- 1 不得设在易污染的地点,对于经常产生有害气体或粉尘的车间,应设在不受污染的生活间或小室内。
- 2 位置应便于取用、检修和清扫,并应设良好的通风和照明设施。
- 3 楼房内饮水供应点的位置,可根据实际情况加以选定。

5.7.9 开水间、饮水处理间应设给水管、排污排水用地漏。给水管管径可按设计小时饮水量计算。开水器、开水炉排污、排水管道应采用金属排水管和耐热塑料排水管。

附录 A 居住小区地下管线（构筑物）间最小净距

表 A 居住小区地下管线（构筑物）间最小净距

种类 种类 净距 (m)	给水管		污水管		雨水管	
	水平	垂直	水平	垂直	水平	垂直
给水管	0.5~1.0	0.1~0.15	0.8~1.5	0.1~0.15	0.8~1.5	0.1~0.15
污水管	0.8~1.5	0.1~0.15	0.8~1.5	0.1~0.15	0.8~1.5	0.1~0.15
雨水管	0.8~1.5	0.1~0.15	0.8~1.5	0.1~0.15	0.8~1.5	0.1~0.15
低压煤气管	0.5~1.0	0.1~0.15	1.0	0.1~0.15	1.0	0.1~0.15
直埋式热水管	1.0	0.1~0.15	1.0	0.1~0.15	1.0	0.1~0.15
热力管沟	0.5~1.0		1.0		1.0	
乔木中心	1.0		1.5		1.5	
电力电缆	1.0	直埋 0.5 穿管 0.25	1.0	直埋 0.5 穿管 0.25	1.0	直埋 0.5 穿管 0.25
通信电缆	1.0	直埋 0.5 穿管 0.15	1.0	直埋 0.5 穿管 0.15	1.0	直埋 0.5 穿管 0.15
通信及 照明电缆	0.5		1.0		1.0	

注：1 净距指管外壁距离，管道交叉设套管时指套管外壁距离，直埋式热力管指保温管壳外壁距离。
2 电力电缆在道路的东侧（南北方向的路）或南侧（东西方向的路）；通信电缆在道路的西侧或北侧。一般均在人行道下。

附录 B 阀门和螺纹管件的摩阻损失的折算补偿长度

表 B 阀门和螺纹管件的摩阻损失的折算补偿长度

管件内径 (mm)	各种管件的折算管道长度 (m)						
	90°标准 弯头	45°标准 弯头	标准三通 90°转角流	三通 直向流	闸板阀	球阀	角阀
9.5	0.3	0.2	0.5	0.1	0.1	2.4	1.2
12.7	0.6	0.4	0.9	0.2	0.1	4.6	2.4
19.1	0.8	0.5	1.2	0.2	0.2	6.1	3.6
25.4	0.9	0.5	1.5	0.3	0.2	7.6	4.6
31.8	1.2	0.7	1.8	0.4	0.2	10.6	5.5
38.1	1.5	0.9	2.1	0.5	0.3	13.7	6.7
50.8	2.1	1.2	3.0	0.6	0.4	16.7	8.5
63.5	2.4	1.5	3.6	0.8	0.5	19.8	10.3

续表 B

管件内径 (mm)	各种管件的折算管道长度 (m)						
	90°标准 弯头	45°标准 弯头	标准三通 90°转角流	三通 直向流	闸板阀	球阀	角阀
76.2	3.0	1.8	4.6	0.9	0.6	24.3	12.2
101.6	4.3	2.4	6.4	1.2	0.8	38.0	16.7
127.0	5.2	3	7.6	1.5	1.0	42.6	21.3
152.4	6.1	3.6	9.1	1.8	1.2	50.2	24.3

注：本表的螺纹接口是指管件无凹口的螺纹，即管件与管道在连接点内径有突变，管件内径大于管道内径。当管件为凹口螺纹，或管件与管道为等径焊接，其折算补偿长度取本表值的二分之一。

附录 C 给水管段卫生器具给水当量同时 出流概率计算式， α_c 系数取值表

表 C $U_o \sim \alpha_c$ 值对应表

U_o (%)	α_c	U_o (%)	α_c
1.0	0.00323	4.0	0.02816
1.5	0.00697	4.5	0.03263
2.0	0.01097	5.0	0.03715
2.5	0.01512	6.0	0.04629
3.0	0.01939	7.0	0.05555
3.5	0.02374	8.0	0.06489

附录 D 给水管段设计秒流量计算表

表 D-1 给水管段设计秒流量计算表 [U : (%); q : (L/s)]

U_o	1.0		1.5		2.0		2.5	
N_g	U	q	U	q	U	q	U	q
1	100.00	0.20	100.00	0.20	100.00	0.20	100.00	0.20
2	70.94	0.28	71.20	0.28	71.49	0.29	71.78	0.29
3	58.00	0.35	58.30	0.35	58.62	0.35	58.96	0.35
4	50.28	0.40	50.60	0.40	50.94	0.41	51.30	0.41
5	45.01	0.45	45.34	0.45	45.69	0.46	46.06	0.46
6	41.12	0.49	41.45	0.50	41.81	0.50	42.18	0.51
7	38.09	0.53	38.43	0.54	38.79	0.54	39.17	0.55
8	35.65	0.57	35.99	0.58	36.36	0.58	36.74	0.59
9	33.63	0.61	33.98	0.61	34.35	0.62	34.73	0.63
10	31.92	0.64	32.27	0.65	32.64	0.65	33.03	0.66

续表 D-1

U_0	1.0		1.5		2.0		2.5	
N_k	U	q	U	q	U	q	U	q
11	30.45	0.67	30.80	0.68	31.17	0.69	31.56	0.69
12	29.17	0.70	29.52	0.71	29.89	0.72	30.28	0.73
13	28.04	0.73	28.39	0.74	28.76	0.75	29.15	0.76
14	27.03	0.76	27.38	0.77	27.76	0.78	28.15	0.79
15	26.12	0.78	26.48	0.79	26.85	0.81	27.24	0.82
16	25.30	0.81	25.66	0.82	26.03	0.83	26.42	0.85
17	24.56	0.83	24.91	0.85	25.29	0.86	25.68	0.87
18	23.88	0.86	24.23	0.87	24.61	0.89	25.00	0.90
19	23.25	0.88	23.60	0.90	23.98	0.91	24.37	0.93
20	22.67	0.91	23.02	0.92	23.40	0.94	23.79	0.95
22	21.63	0.95	21.98	0.97	22.36	0.98	22.75	1.00
24	20.72	0.99	21.07	1.01	21.45	1.03	21.85	1.05
26	19.92	1.04	20.27	1.05	20.65	1.07	21.05	1.09
28	19.21	1.08	19.56	1.10	19.94	1.12	20.33	1.14
30	18.56	1.11	18.92	1.14	19.30	1.16	19.69	1.18
32	17.99	1.15	18.34	1.17	18.72	1.20	19.12	1.22
34	17.46	1.19	17.81	1.21	18.19	1.24	18.59	1.26
36	16.97	1.22	17.33	1.25	17.71	1.28	18.11	1.30
38	16.53	1.26	16.89	1.28	17.27	1.31	17.66	1.34
40	16.12	1.29	16.48	1.32	16.86	1.35	17.25	1.38
42	15.74	1.32	16.09	1.35	16.47	1.38	16.87	1.42
44	15.38	1.35	15.74	1.39	16.12	1.42	16.52	1.45
46	15.05	1.38	15.41	1.42	15.79	1.45	16.18	1.49
48	14.74	1.42	15.10	1.45	15.48	1.49	15.87	1.52
50	14.45	1.45	14.81	1.48	15.19	1.52	15.58	1.56
55	13.79	1.52	14.15	1.56	14.53	1.60	14.92	1.64
60	13.22	1.59	13.57	1.63	13.95	1.67	14.35	1.72
65	12.71	1.65	13.07	1.70	13.45	1.75	13.84	1.80
70	12.26	1.72	12.62	1.77	13.00	1.82	13.39	1.87
75	11.85	1.78	12.21	1.83	12.59	1.89	12.99	1.95
80	11.49	1.84	11.84	1.89	12.22	1.96	12.62	2.02
85	11.15	1.90	11.51	1.96	11.89	2.02	12.28	2.09
90	10.85	1.95	11.20	2.02	11.58	2.09	11.98	2.16
95	10.57	2.01	10.92	2.08	11.30	2.15	11.70	2.22
100	10.31	2.06	10.66	2.13	11.04	2.21	11.44	2.29
110	9.84	2.17	10.20	2.24	10.58	2.33	10.97	2.41

续表 D-1

U_0	1.0		1.5		2.0		2.5	
N_g	U	q	U	q	U	q	U	q
120	9.44	2.26	9.79	2.35	10.17	2.44	10.56	2.54
130	9.08	2.36	9.43	2.45	9.81	2.55	10.21	2.65
140	8.76	2.45	9.11	2.55	9.49	2.66	9.89	2.77
150	8.47	2.54	8.83	2.65	9.20	2.76	9.60	2.88
160	8.21	2.63	8.57	2.74	8.94	2.86	9.34	2.99
170	7.98	2.71	8.33	2.83	8.71	2.96	9.10	3.09
180	7.76	2.79	8.11	2.92	8.49	3.06	8.89	3.20
190	7.56	2.87	7.91	3.01	8.29	3.15	8.69	3.30
200	7.38	2.95	7.73	3.09	8.11	3.24	8.50	3.40
220	7.05	3.10	7.40	3.26	7.78	3.42	8.17	3.60
240	6.76	3.25	7.11	3.41	7.49	3.60	7.88	3.78
260	6.51	3.28	6.86	3.57	7.24	3.76	7.63	3.97
280	6.28	3.52	6.63	3.72	7.01	3.93	7.40	4.15
300	6.08	3.65	6.43	3.86	6.81	4.08	7.20	4.32
320	5.89	3.77	6.25	4.00	6.62	4.24	7.02	4.49
340	5.73	3.89	6.08	4.13	6.46	4.39	6.85	4.66
360	5.57	4.01	5.93	4.27	6.30	4.54	6.69	4.82
380	5.43	4.13	5.79	4.40	6.16	4.68	6.55	4.98
400	5.30	4.24	5.66	4.52	6.03	4.83	6.42	5.14
420	5.18	4.35	5.54	4.65	5.91	4.96	6.30	5.29
440	5.07	4.46	5.42	4.77	5.80	5.10	6.19	5.45
460	4.97	4.57	5.32	4.89	5.69	5.24	6.08	5.60
480	4.87	4.67	5.22	5.01	5.59	5.37	5.98	5.75
500	4.78	4.78	5.13	5.13	5.50	5.50	5.89	5.89
550	4.57	5.02	4.92	5.41	5.29	5.82	5.68	6.25
600	4.39	5.26	4.74	5.68	5.11	6.13	5.50	6.60
650	4.23	5.49	4.58	5.95	4.95	6.43	5.34	6.94
700	4.08	5.72	4.43	6.20	4.81	6.73	5.19	7.27
750	3.95	5.93	4.30	6.46	4.68	7.02	5.07	7.60
800	3.84	6.14	4.19	6.70	4.56	7.30	4.95	7.92
850	3.73	6.34	4.08	6.94	4.45	7.57	4.84	8.23
900	3.64	6.54	3.98	7.17	4.36	7.84	4.75	8.54
950	3.55	6.74	3.90	7.40	4.27	8.11	4.66	8.85
1000	3.46	6.93	3.81	7.63	4.19	8.37	4.57	9.15
1100	3.32	7.30	3.66	8.06	4.04	8.88	4.42	9.73
1200	3.09	7.65	3.54	8.49	3.91	9.38	4.29	10.31

续表 D-1

U_0	1.0		1.5		2.0		2.5	
N_8	U	q	U	q	U	q	U	q
1300	3.07	7.99	3.42	8.90	3.79	9.86	4.18	10.87
1400	2.97	8.33	3.32	9.30	3.69	10.34	4.08	11.42
1500	2.88	8.65	3.23	9.69	3.60	10.80	3.99	11.96
1600	2.80	8.96	3.15	10.07	3.52	11.26	3.90	12.49
1700	2.73	9.27	3.07	10.45	3.44	11.71	3.83	13.02
1800	2.66	9.57	3.00	10.81	3.37	12.15	3.76	13.53
1900	2.59	9.86	2.94	11.17	3.31	12.58	3.70	14.04
2000	2.54	10.14	2.88	11.53	3.25	13.01	3.64	14.55
2200	2.43	10.70	2.78	12.22	3.15	13.85	3.53	15.54
2400	2.34	11.23	2.69	12.89	3.06	14.67	3.44	16.51
2600	2.26	11.75	2.61	13.55	2.97	15.47	3.36	17.46
2800	2.19	12.26	2.53	14.19	2.90	16.25	3.29	18.40
3000	2.12	12.75	2.47	14.81	2.84	17.03	3.22	19.33
3200	2.07	13.22	2.41	15.43	2.78	17.79	3.16	20.24
3400	2.01	13.69	2.36	16.03	2.73	18.54	3.11	21.14
3600	1.96	14.15	2.13	16.62	2.68	19.27	3.06	22.03
3800	1.92	14.59	2.26	17.21	2.63	20.00	3.01	22.91
4000	1.88	15.03	2.22	17.78	2.59	20.72	2.97	23.78
4200	1.84	15.46	2.18	18.35	2.55	21.43	2.93	24.64
4400	1.80	15.88	2.15	18.91	2.52	22.14	2.90	25.50
4600	1.77	16.30	2.12	19.46	2.48	22.84	2.86	26.35
4800	1.74	16.71	2.08	20.00	2.45	23.53	2.83	27.19
5000	1.71	17.11	2.05	20.54	2.42	24.21	2.80	28.03
5500	1.65	18.10	1.99	21.87	2.35	25.90	2.74	30.09
6000	1.59	19.05	1.93	23.16	2.30	27.55	2.68	32.12
6500	1.54	19.97	1.88	24.43	2.24	29.18	2.63	34.13
7000	1.49	20.88	1.83	25.67	2.20	30.78	2.58	36.11
7500	1.45	21.76	1.79	26.88	2.16	32.36	2.54	38.06
8000	1.41	22.62	1.76	28.08	2.12	33.92	2.50	40.00
8500	1.38	23.46	1.72	29.26	2.09	35.47		
9000	1.35	24.29	1.69	30.43	2.06	36.99		
9500	1.32	25.10	1.66	31.58	2.03	38.50		
10000	1.29	25.90	1.64	32.72	2.00	40.00		
11000	1.25	27.46	1.59	34.95				
12000	1.21	28.97	1.55	37.14				
13000	1.17	30.45	1.51	39.29				

续表 D-1

U_0	1.0		1.5		2.0		2.5	
N_g	U	q	U	q	U	q	U	q
14000	1.14	31.89	$N_g = 13333$ $U = 1.5$ $q = 40$					
15000	1.11	33.31						
16000	1.08	34.69						
17000	1.06	36.05						
18000	1.04	37.39						
19000	1.02	38.70						
20000	1.00	40.00						

表 D-2 给水管段设计秒流量计算表 [U : (%); q : (L/s)]

U_0	3.0		3.5		4.0		4.5	
N_g	U	q	U	q	U	q	U	q
1	100.00	0.20	100.00	0.20	100.00	0.20	100.00	0.20
2	72.08	0.29	72.39	0.29	72.70	0.29	73.02	0.29
3	59.31	0.36	59.66	0.36	60.02	0.36	60.38	0.36
4	51.66	0.41	52.03	0.42	52.41	0.42	52.80	0.42
5	46.43	0.46	46.82	0.47	47.21	0.47	47.60	0.48
6	42.57	0.51	42.96	0.52	43.35	0.52	43.76	0.53
7	39.56	0.55	39.96	0.56	40.36	0.57	40.76	0.57
8	37.13	0.59	37.53	0.60	37.94	0.61	38.35	0.61
9	35.12	0.63	35.53	0.64	35.93	0.65	36.35	0.65
10	33.42	0.67	33.83	0.68	34.24	0.68	34.65	0.69
11	31.96	0.70	32.36	0.71	32.77	0.72	33.19	0.73
12	30.68	0.74	31.09	0.75	31.50	0.76	31.92	0.77
13	29.55	0.77	29.96	0.78	30.37	0.79	30.79	0.80
14	28.55	0.80	28.96	0.81	29.37	0.82	29.79	0.83
15	27.64	0.83	28.05	0.84	28.47	0.85	28.89	0.87
16	26.83	0.86	27.24	0.87	27.65	0.88	28.08	0.90
17	26.08	0.89	26.49	0.90	26.91	0.91	27.33	0.93
18	25.40	0.91	25.81	0.93	26.23	0.94	26.65	0.96
19	24.77	0.94	25.19	0.96	25.60	0.97	26.03	0.99
20	24.20	0.97	24.61	0.98	25.03	1.00	25.45	1.02
22	23.16	1.02	23.57	1.04	23.99	1.06	24.41	1.07
24	22.25	1.07	22.66	1.09	23.08	1.11	23.51	1.13
26	21.45	1.12	21.87	1.14	22.29	1.16	22.71	1.18
28	20.74	1.16	21.15	1.18	21.57	1.21	22.00	1.23
30	20.10	1.21	20.51	1.23	20.93	1.26	21.36	1.28
32	19.52	1.25	19.94	1.28	20.36	1.30	20.78	1.33
34	18.99	1.29	19.41	1.32	19.83	1.35	20.25	1.38
36	18.51	1.33	18.93	1.36	19.35	1.39	19.77	1.42
38	18.07	1.37	18.48	1.40	18.90	1.44	19.33	1.47

续表 D-2

U_0	3.0		3.5		4.0		4.5	
N_g	U	q	U	q	U	q	U	q
40	17.66	1.41	18.07	1.45	18.49	1.48	18.92	1.51
42	17.28	1.45	17.69	1.49	18.11	1.52	18.54	1.56
44	16.92	1.49	17.34	1.53	17.76	1.56	18.18	1.60
46	16.59	1.53	17.00	1.56	17.43	1.60	17.85	1.64
48	16.28	1.56	16.69	1.60	17.11	1.64	17.54	1.68
50	15.99	1.60	16.40	1.64	16.82	1.68	17.25	1.73
55	15.33	1.69	15.74	1.73	16.17	1.78	16.59	1.82
60	14.76	1.77	15.17	1.82	15.59	1.87	16.02	1.92
65	14.25	1.85	14.66	1.91	15.08	1.96	15.51	2.02
70	13.80	1.93	14.21	1.99	14.63	2.05	15.06	2.11
75	13.39	2.01	13.81	2.07	14.23	2.13	14.65	2.20
80	13.02	2.08	13.44	2.15	13.86	2.22	14.28	2.29
85	12.69	2.16	13.10	2.23	13.52	2.30	13.95	2.37
90	12.38	2.23	12.80	2.30	13.22	2.38	13.64	2.46
95	12.10	2.30	12.52	2.38	12.94	2.46	13.36	2.54
100	11.84	2.37	12.26	2.45	12.68	2.54	13.10	2.62
110	11.38	2.50	11.79	2.59	12.21	2.69	12.63	2.78
120	10.97	2.63	11.38	2.73	11.80	2.83	12.23	2.93
130	10.61	2.76	11.02	2.87	11.44	2.98	11.87	3.09
140	10.29	2.88	10.70	3.00	11.12	3.11	11.55	3.23
150	10.00	3.00	10.42	3.12	10.83	3.25	11.26	3.38
160	9.74	3.12	10.16	3.25	10.57	3.38	11.00	3.52
170	9.51	3.23	9.92	3.37	10.34	3.51	10.76	3.66
180	9.29	3.34	9.70	3.49	10.12	3.64	10.54	3.80
190	9.09	3.45	9.50	3.61	9.92	3.77	10.34	3.93
200	8.91	3.56	9.32	3.73	9.74	3.89	10.16	4.06
220	8.57	3.77	8.99	3.95	9.40	4.14	9.83	4.32
240	8.29	3.98	8.70	4.17	9.12	4.38	9.54	4.58
260	8.03	4.18	8.44	4.39	8.86	4.61	9.28	4.83
280	7.81	4.37	8.22	4.60	8.63	4.83	9.06	5.07
300	7.60	4.56	8.01	4.81	8.43	5.06	8.85	5.31
320	7.42	4.75	7.83	5.01	8.24	5.28	8.67	5.55
340	7.25	4.93	7.66	5.21	8.08	5.49	8.50	5.78
360	7.10	5.11	7.51	5.40	7.92	5.70	8.34	6.01
380	6.95	5.29	7.36	5.60	7.78	5.91	8.20	6.23
400	6.82	5.46	7.23	5.79	7.65	6.12	8.07	6.46
420	6.70	5.63	7.11	5.97	7.53	6.32	7.95	6.68
440	6.59	5.80	7.00	6.16	7.41	6.52	7.83	6.89

续表 D-2

U_0	3.0		3.5		4.0		4.5	
N_g	U	q	U	q	U	q	U	q
460	6.48	5.97	6.89	6.34	7.31	6.72	7.73	7.11
480	6.39	6.13	6.79	6.52	7.21	6.92	7.63	7.32
500	6.29	6.29	6.70	6.70	7.12	7.12	7.54	7.54
550	6.08	6.69	6.49	7.14	6.91	7.60	7.32	8.06
600	5.90	7.08	6.31	7.57	6.72	8.07	7.14	8.57
650	5.74	7.46	6.15	7.99	6.56	8.53	6.98	9.07
700	5.59	7.83	6.00	8.40	6.42	8.98	6.83	9.57
750	5.46	8.20	5.87	8.81	6.29	9.43	6.70	10.06
800	5.35	8.56	5.75	9.21	6.17	9.87	6.59	10.54
850	5.24	8.91	5.65	9.60	6.06	10.30	6.48	11.01
900	5.14	9.26	5.55	9.99	5.96	10.73	6.38	11.48
950	5.05	9.60	5.46	10.37	5.87	11.16	6.29	11.95
1000	4.97	9.94	5.38	10.75	5.79	11.58	6.21	12.41
1100	4.82	10.61	5.23	11.50	5.64	12.41	6.06	13.32
1200	4.69	11.26	5.10	12.23	5.51	13.22	5.93	14.22
1300	4.58	11.90	4.98	12.95	5.39	14.02	5.81	15.11
1400	4.48	12.53	4.88	13.66	5.29	14.81	5.71	15.98
1500	4.38	13.15	4.79	14.36	5.20	15.60	5.61	16.84
1600	4.30	13.76	4.70	15.05	5.11	16.37	5.53	17.70
1700	4.22	14.36	4.63	15.74	5.04	17.13	5.45	18.54
1800	4.16	14.96	4.56	16.41	4.97	17.89	5.38	19.38
1900	4.09	15.55	4.49	17.08	4.90	18.64	5.32	20.21
2000	4.03	16.13	4.44	17.74	4.85	19.38	5.26	21.04
2200	3.93	17.28	4.33	19.05	4.74	20.85	5.15	22.67
2400	3.83	18.41	4.24	20.34	4.65	22.30	5.06	24.29
2600	3.75	19.52	4.16	21.61	4.56	23.73	4.98	25.88
2800	3.68	20.61	4.08	22.86	4.49	25.15	4.90	27.46
3000	3.62	21.69	4.02	24.10	4.42	26.55	4.84	29.02
3200	3.56	22.76	3.96	25.33	4.36	27.94	4.78	30.58
3400	3.50	23.81	3.90	26.54	4.31	29.31	4.72	32.12
3600	3.45	24.86	3.85	27.75	4.26	30.68	4.67	33.64
3800	3.41	25.90	3.81	28.94	4.22	32.03	4.63	35.16
4000	3.37	26.92	3.77	30.13	4.17	33.38	4.58	36.67
4200	3.33	27.94	3.73	31.30	4.13	34.72	4.54	38.17
4400	3.29	28.95	3.69	32.47	4.10	36.05	4.51	39.67
4600	3.26	29.96	3.66	33.64	4.06	37.37	$N_g = 4444$ $U = 4.5\%$ $q = 40.00$	
4800	3.22	30.95	3.62	34.79	4.03	38.69		
5000	3.19	31.95	3.59	35.94	4.00	40.00		

续表 D-2

U_0	3.0		3.5		4.0		4.5	
N_g	U	q	U	q	U	q	U	q
5500	3.13	34.40	3.53	38.79				
6000	3.07	36.82	$N_g = 5714$ $U = 3.5\%$ $q = 40.00$					
6500	3.02	39.21						
6667	3.00	40.00						

表 D-3 给水管段设计秒流量计算表 [U : (%); q : (L/s)]

U_0	5.0		6.0		7.0		8.0	
N_g	U	q	U	q	U	q	U	q
1	100.00	0.20	100.00	0.20	100.00	0.20	100.00	0.20
2	73.33	0.29	73.98	0.30	74.64	0.30	75.30	0.30
3	60.75	0.36	61.49	0.37	62.24	0.37	63.00	0.38
4	53.18	0.43	53.97	0.43	54.76	0.44	55.56	0.44
5	48.00	0.48	48.80	0.49	49.62	0.50	50.45	0.50
6	44.16	0.53	44.98	0.54	45.81	0.55	46.65	0.56
7	41.17	0.58	42.01	0.59	42.85	0.60	43.70	0.61
8	38.76	0.62	39.60	0.63	40.45	0.65	41.31	0.66
9	36.76	0.66	37.61	0.68	38.46	0.69	39.33	0.71
10	35.07	0.70	35.92	0.72	36.78	0.74	37.65	0.75
11	33.61	0.74	34.46	0.76	35.33	0.78	36.20	0.80
12	32.34	0.78	33.19	0.80	34.06	0.82	34.93	0.84
13	31.22	0.81	32.07	0.83	32.94	0.86	33.82	0.88
14	30.22	0.85	31.07	0.87	31.94	0.89	32.82	0.92
15	29.32	0.88	30.18	0.91	31.05	0.93	31.93	0.96
16	28.50	0.91	29.36	0.94	30.23	0.97	31.12	1.00
17	27.76	0.94	28.62	0.97	29.50	1.00	30.38	1.03
18	27.08	0.97	27.94	1.01	28.82	1.04	29.70	1.07
19	26.45	1.01	27.32	1.04	28.19	1.07	29.08	1.10
20	25.88	1.04	26.74	1.07	27.62	1.10	28.50	1.14
22	24.84	1.09	25.71	1.13	26.58	1.17	27.47	1.21
24	23.94	1.15	24.80	1.19	25.68	1.23	26.57	1.28
26	23.14	1.20	24.01	1.25	24.98	1.29	25.77	1.34
28	22.43	1.26	23.30	1.30	24.18	1.35	25.06	1.40
30	21.79	1.31	22.66	1.36	23.54	1.41	24.43	1.47
32	21.21	1.36	22.08	1.41	22.96	1.47	23.85	1.53
34	20.68	1.41	21.55	1.47	22.43	1.53	23.32	1.59
36	20.20	1.45	21.07	1.52	21.95	1.58	22.84	1.64
38	19.76	1.50	20.63	1.57	21.51	1.63	22.40	1.70
40	19.35	1.55	20.22	1.62	21.10	1.69	21.99	1.76
42	18.97	1.59	19.84	1.67	20.72	1.74	21.61	1.82
44	18.61	1.64	19.48	1.71	20.36	1.79	21.25	1.87

续表 D-3

U_0	5.0		6.0		7.0		8.0	
N_g	U	q	U	q	U	q	U	q
46	18.28	1.68	19.15	1.76	20.03	1.84	20.92	1.92
48	17.97	1.73	18.84	1.81	19.72	1.89	20.61	1.98
50	17.68	1.77	18.55	1.86	19.43	1.94	20.32	2.03
55	17.02	1.87	17.89	1.97	18.77	2.07	19.66	2.16
60	16.45	1.97	17.32	2.08	18.20	2.18	19.08	2.29
65	15.94	2.07	16.81	2.19	17.69	2.30	18.58	2.42
70	15.49	2.17	16.36	2.29	17.24	2.41	18.13	2.54
75	15.08	2.26	15.95	2.39	16.83	2.52	17.72	2.66
80	14.71	2.35	15.58	2.49	16.46	2.63	17.35	2.78
85	14.38	2.44	15.25	2.59	16.13	2.74	17.02	2.89
90	14.07	2.53	14.94	2.69	15.82	2.85	16.71	3.01
95	13.79	2.62	14.66	2.79	15.54	2.95	16.43	3.12
100	13.53	2.71	14.40	2.88	15.28	3.06	16.17	3.23
110	13.06	2.87	13.93	3.06	14.81	3.26	15.70	3.45
120	12.66	3.04	13.52	3.25	14.40	3.46	15.29	3.67
130	12.30	3.20	13.16	3.42	14.04	3.65	14.93	3.88
140	11.97	3.35	12.84	3.60	13.72	3.84	14.61	4.09
150	11.69	3.51	12.55	3.77	13.43	4.03	14.32	4.30
160	11.43	3.66	12.29	3.93	13.17	4.21	14.06	4.50
170	11.19	3.80	12.05	4.10	12.93	4.40	13.82	4.70
180	10.97	3.95	11.84	4.26	12.71	4.58	13.60	4.90
190	10.77	4.09	11.64	4.42	12.51	4.75	13.40	5.09
200	10.59	4.23	11.45	4.58	12.33	4.93	13.21	5.28
220	10.25	4.51	11.12	4.89	11.99	5.28	12.88	5.67
240	9.96	4.78	10.83	5.20	11.70	5.62	12.59	6.04
260	9.71	5.05	10.57	5.50	11.45	5.95	12.33	6.41
280	9.48	5.31	10.34	5.79	11.22	6.28	12.10	6.78
300	9.28	5.57	10.14	6.08	11.01	6.61	11.89	7.14
320	9.09	5.82	9.95	6.37	10.83	6.93	11.71	7.49
340	8.92	6.07	9.78	6.65	10.66	7.25	11.54	7.84
360	8.77	6.31	9.63	6.93	10.50	7.56	11.38	8.19
380	8.63	6.56	9.49	7.21	10.36	7.87	11.24	8.54
400	8.49	6.80	9.35	7.48	10.23	8.18	11.10	8.88
420	8.37	7.03	9.23	7.76	10.10	8.49	10.98	9.22

续表 D-3

U_0	5.0		6.0		7.0		8.0	
N_k	U	q	U	q	U	q	U	q
440	8.26	7.27	9.12	8.02	9.99	8.79	10.87	9.56
460	8.15	7.50	9.01	8.29	9.88	9.09	10.76	9.90
480	8.05	7.73	8.91	8.56	9.78	9.39	10.66	10.23
500	7.96	7.96	8.82	8.82	9.69	9.69	10.56	10.56
550	7.75	8.52	8.61	9.47	9.47	10.42	10.35	11.39
600	7.56	9.08	8.42	10.11	9.29	11.15	10.16	12.20
650	7.40	9.62	8.26	10.74	9.12	11.86	10.00	13.00
700	7.26	10.16	8.11	11.36	8.98	12.57	9.85	13.79
750	7.13	10.69	7.98	11.97	8.85	13.27	9.72	14.58
800	7.01	11.21	7.86	12.58	8.73	13.96	9.60	15.36
850	6.90	11.73	7.75	13.18	8.62	14.65	9.49	16.14
900	6.80	12.24	7.66	13.78	8.52	15.34	9.39	16.91
950	6.71	12.75	7.56	14.37	8.43	16.01	9.30	17.67
1000	6.63	13.26	7.48	14.96	8.34	16.69	9.22	18.43
1100	6.48	14.25	7.33	16.12	8.19	18.02	9.06	19.94
1200	6.35	15.23	7.20	17.27	8.06	19.34	8.93	21.43
1300	6.23	16.20	7.08	18.41	7.94	20.65	8.81	22.91
1400	6.13	17.15	6.98	19.53	7.84	21.95	8.71	24.38
1500	6.03	18.10	6.88	20.65	7.74	23.23	8.61	25.84
1600	5.95	19.04	6.80	21.76	7.66	24.51	8.53	27.28
1700	5.87	19.97	6.72	22.85	7.58	25.77	8.45	28.72
1800	5.80	20.89	6.65	23.94	7.51	27.03	8.38	30.15
1900	5.74	21.80	6.59	25.03	7.44	28.29	8.31	31.58
2000	5.68	22.71	6.53	26.10	7.38	29.53	8.25	33.00
2200	5.57	24.51	6.42	28.24	7.27	32.01	8.14	35.81
2400	5.48	26.29	6.32	30.35	7.18	34.46	8.04	38.60
2600	5.39	28.05	6.24	32.45	7.10	36.89	$N_k = 2500$ $U = 8.0\%$ $q = 40.00$	
2800	5.32	29.80	6.17	34.52	7.02	39.31		
3000	5.25	31.53	6.10	36.59	$N_k = 2857$ $U = 7.0\%$ $q = 40.00$			
3200	5.19	33.24	6.04	38.64				
3400	5.14	34.95	$N_k = 3333$ $U = 6.0\%$ $q = 40.00$					
3600	5.09	36.64						
3800	5.04	38.33						
4000	5.00	40.00						

附录 E 饮用净水计算管段上同时使用水嘴的数量

E.0.1 在水嘴设置数量 12 个及 12 个以下时水嘴同时使用数量。

水嘴设置数量 n	1	2	3	4~8	9~12
同时使用数量 m	1	2	3	3	4

E.0.2 在水嘴设置数量 12 个以上时水嘴同时使用数量。

$\begin{matrix} P \\ m \\ n \end{matrix}$	$P = \alpha q_h / 1800 n q_0$ $\alpha = 0.6 \sim 0.9$; n —饮用净水水嘴总数; q_h —设计小时流量 (L/h); q_0 —饮用净水水嘴额定流量 (L/s)																		
	0.010	0.015	0.020	0.025	0.030	0.035	0.040	0.045	0.050	0.055	0.060	0.065	0.070	0.075	0.080	0.085	0.090	0.095	0.10
13~25	2	2	3	3	3	4	4	4	4	5	5	5	5	5	6	6	6	6	6
50	3	3	4	4	5	5	6	6	7	7	7	8	8	9	9	9	10	10	10
75	3	4	5	6	6	7	8	8	9	9	10	10	11	11	12	13	13	14	14
100	4	5	6	7	8	8	9	10	11	11	12	13	13	14	15	16	16	17	18
125	4	6	7	8	9	10	11	12	13	13	14	15	16	17	18	18	19	20	21
150	5	6	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24
175	5	7	8	10	11	12	14	15	16	17	18	20	21	22	23	24	25	26	27
200	6	8	9	11	12	14	15	16	18	19	20	22	23	24	25	27	28	29	30
225	6	8	10	12	13	15	16	18	19	21	22	24	25	27	28	29	31	32	34
250	7	9	11	13	14	16	18	19	21	23	24	26	27	29	31	32	34	35	37
275	7	9	12	14	15	17	19	21	23	25	26	28	30	31	33	35	36	38	40
300	8	10	12	14	16	19	21	22	24	26	28	30	32	34	36	37	39	41	43
325	8	11	13	15	18	20	22	24	26	28	30	32	34	36	38	40	42	44	46
350	8	11	14	16	19	21	23	25	28	30	32	34	36	38	40	42	45	47	49
375	9	12	14	17	20	22	24	27	29	32	34	36	38	41	43	45	47	49	52
400	9	12	15	18	21	23	26	28	31	33	36	38	40	43	45	48	50	52	55
425	10	13	16	19	22	24	27	30	32	35	37	40	43	45	48	50	53	55	57

注: 1 n 可用内插法。

2 m 小数点后四舍五入。

本规范用词说明

- 1 为便于在执行本规范条文时区别对待，对要求严格程度不同的用词说明如下：
 - 1) 表示很严格，非这样做不可的用词：
正面词采用“必须”，反面词采用“严禁”。
 - 2) 表示严格，在正常情况下均应这样做的用词：
正面词采用“应”，反面词采用“不应”或“不得”。
 - 3) 表示允许稍有选择，在条件许可时首先应这样做的用词：
正面词采用“宜”，反面词采用“不宜”；
表示有选择，在一定条件下可以这样做的用词，采用“可”。
- 2 本规范中指明应按其他有关标准、规范执行的写法为“应符合……的规定”或“应按……执行”。