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Волгоградский государственный архитектурно-строительный университет

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Содержатся тексты и упражнения для чтения технической литературы по теплогазоснабжению и вентиляции с целью развития разговорных навыков и навыков чтения. Могут быть использованы как на аудиторных занятиях, так и в самостоятельной работе.

Для студентов факультета инженерных систем и техносферной безопасности.

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UNIT 1

1. Вспомните, какие русские слова имеют те же корни, что и следующие английские; используйте их для понимания текста:

atmospheric, specially, radiator, generate, panel, method, manufacture natural, individual, temperature, control, automatically.

2. Запомните значения следующих слов и словосочетаний для лучшего понимания текста:

atmospheric environment	атмосферная среда
as well as	так же как и ...
central heating	центральное отопление
hot water (heating) system	система водяного отопления
boiler	котел
steam (heating) system	паровое отопление
copper pipe	медная труба
as for	что касается; что до ...
either ... or	или ... или
panel heating system	панельное скопление
advantage	выгода, польза
cleanliness	чистота
equable	равномерный
ash	пепел, зола

3. Подберите значения к следующим английским словам:

1) branch	a) состоять из ...
2) environment	b) проектировать, проект
3) definite	c) воздух
4) closely	d) в наше время, теперь
5) necessary	e) отрасль
6) to design	f) тесно
7) to consist (of) ...	g) определенный
8) air	h) употреблять
9) nowadays	i) необходимый
10) to use	j) окружающая среда

4. Найдите в словаре и запишите значения следующих слов:

to connect, to concern, full, basement, suitable, to serve, purpose, gravity, pump, otherwise, emit, surface, to maintain.

5. Определите по суффиксам, какие из данных слов являются существительными и какие — прилагательными:

natural, electricity, atmospheric, temperature, central, ventilation, environment, particular, basement, individual.

6. Назовите прилагательные, имеющие общий корень с данными существительными; переведите их:

copper, purpose, environment, nature, necessity, center, advantage.

7. Назовите английские глаголы, от которых образованы следующие существительные; переведите их:

ventilation, environment, heating, basement, building, boiler, cleanliness, concealment.

8. Найдите в тексте английские эквиваленты следующих предложений; обратите внимание на глаголы в страдательном залоге; прочитайте и переведите текст.

1. Отопление и вентиляция — это две отрасли техники, которые тесно связаны.

2. Трубы обычно изготавливаются из стали.

3. Топливо сжигается в определенном месте.

4. Кондиционирование воздуха тесно связано как с отоплением, так и с вентиляцией.

5. Охлажденная вода возвращается в котел, где она подогревается.

HEATING

Heating and ventilation are two branches of engineering which are very closely connected and concerned with providing a required atmospheric environment within a definite space. Air-conditioning is closely related to heating as well as ventilation.

The most widely used system of heating is the central heating, where the fuel is burned in one particular place — the basement or a specially designed room for the purpose from which steam, hot water or warm air is transmitted to all the necessary places to be heated.

The hot water system and the steam system are at present the two most common system of heating. A hot water system consists of a boiler and a whole system of pipes which are connected to all the radiators suitable located in the building.

The pipes are usually made of steel. But they can be made of copper and plastics too. In fact, copper pipes serve the purpose very well. The pipes feed hot water to radiators or convectors. The cooled water is returned to the boiler where it is reheated.

As for steam systems steam is generated in the boiler and then it is conveyed to the radiators through pipes. The steam gives up its heat to the radiators and the radiators to the room and the cooling of the steam condenses it to water.

The condensate is returned to the boiler either by gravity or by a pump. The air valve on each radiator is necessary for air to escape. Otherwise it would prevent steam from entering the radiator.

Panel heating is a method of introducing heat to rooms in which the emitting surfaces are usually completely concealed in the floor, walls or ceiling.

As for fuels used for heating buildings they include coal, oil, manufactured and natural gases and wood. There are two other sources: electricity and steam. Nowadays gas fuel is being used on an ever increasing level.

The advantages of central heating are:

- 1) fuel and ashes are kept outside the occupied spaces;
- 2) individual fuels are not required;
- 3) cleanliness;
- 4) equable temperature maintained in all parts, easily controlled automatically.

9. Подберите соответствующий перевод из правого столбца к данным английским словам:

- | | |
|------------------|-------------------------------|
| 1) steam heating | a) подогревать |
| 2) purpose | b) котел |
| 3) to feed | c) сила тяжести |
| 4) to reheat | d) клапан |
| 5) to generate | e) дерево |
| 6) boiler | f) топливо |
| 7) to conceal | g) цель |
| 8) gravity | h) насос |
| 9) valve | i) скрывать |
| 10) to require | j) паровое отопление |
| 11) pump | k) подавать, снабжать (водой) |
| 12) wood | l) производить |
| 13) fuel | m) требовать |

10. Укажите, какое из данных предложений отражает основное содержание текста.

1. Individual fuels are not required.
2. Two steam heating systems: the single pipe system and the two pipe system.
3. Heating is a branch of engineering which is concerned with providing heat supply to produce a desired temperature within a space.
4. The pipes are usually made of steel.
5. A hot water system consists of the boilers and a system of pipes.

11. Расположите предложения согласно последовательности изложения.

1. The advantages of central heating.
2. Fuel used for heating buildings.

3. The two most common systems of heating.
4. The principle of central heating.

12. В соответствии с содержанием текста найдите правильные ответы на вопросы.

1. What are heating and ventilation concerned with?
 - A. Heating and ventilation deal with supply and removal of air.
 - B. Heating and ventilation are concerned with providing a required atmospheric environment within a space.
 - C. Heating and ventilation are meant for heat supply to produce a desired temperature.
2. What two common systems of heating are widely used at present?
 - A. Air conditioning is a system of heating which is widely used at present.
 - B. Only hot water system is widely used now.
 - C. The hot water system and the steam system are at present the two most common systems of heating.

13. Дополните незаконченные предложения необходимыми по смыслу аргументами.

1. Heating and ventilation are very closely connected for ...
2. The central heating system is widely used because ...
3. The central heating system has some advantages as ...

14. Найдите, какие из данных предложений относятся к описанию отопления и какие к описанию вентиляции.

1. This system consists of the boilers and a system of pipes connected with radiators located in room.
2. This branch of engineering is associated with cleaning of air.
3. In this system we have the single-pipe system and the two pipe system.
4. In general, the system should be designed so that the water will circulate by gravity.
5. No measurements of air contamination were taken.

15. Переведите предложения на русский язык.

1. In the single-pipe system the steam is conveyed to the radiator through a pipe at the bottom of one of the end section. The condensation which forms in the radiator flows back through the same pipe.
2. In the two-pipe system a separate system of piping is provided. The purpose of this separate system of piping is to carry away the condensation and in some cases the air from the radiator.

16. Выразите согласие или несогласие в следующих утверждениях, используя в них:

а) выражения согласия:

You are quite (absolutely) right; Quite right. Quite true; Yes, of course; I quite agree with you;

б) выражения несогласия:

You are wrong (mistaken); Certainly not; On the contrary; Oh, no, I disagree with you.

1. Heating and ventilation are two separate branches of engineering which are not connected in any way.

2. There are two main heating systems.

3. In central heating system rooms are heated by the medium such as steam or hot-water.

4. Central heating systems are never used for heating of residential public and industrial buildings.

5. With panel heating the source of heat is located in the room in the form of a special radiator.

17. Ответьте на следующие вопросы, давая как можно больше вариантов ответа в соответствии с содержанием текста.

1. What is necessary to maintain comfort in a building?

2. Why have new methods of heating come into being?

18. Переведите текст без словаря.

Modern methods of heating are divided into two main heating systems: direct and indirect.

Direct systems are those in which the fuel is consumed in the room to be heated.

Indirect systems are those in which the fuel is consumed outside the room, the heat being conveyed to the room by the medium such as steam or hot water.

Indirect systems are used for the continuous heating of large buildings of all types from one central source: hence the name Central Heating.

Heat carrying agents, used in central heating systems, are hot water, steam and air.

In the climatic conditions of the Soviet Union, heating is required, in residential, public and industrial buildings.

Various types of stoves are used to heat room of small isolated buildings in worker's communities along railway lines in state and cooperative farms, etc. But this type of heating takes a lot of time and effort. For this reason a system of central heating should be installed even in buildings of small communities.

Notes to the text

direct heating	лучистое (прямое) отопление
indirect heating	косвенный обогрев
consume	потреблять, расходовать (сжигать)
by the medium	через, посредством
continuous heating	нерегулируемое отопление
hence	отсюда
worker's community	рабочий поселок

19. Расскажите на английском языке все, что знаете об отоплении.

UNIT 2

1. Вспомните, какие русские слова имеют те же корни, что и следующие английские:

modern, technology, comfort, theaters, residence, mechanical, filter, system, structure, excess, person, limit, associate, industrial, problem, process, production, toxic.

2. Запомните значения следующих слов и словосочетаний для лучшего понимания текста:

air conditioning	кондиционирование воздуха
treatment of air	очистка воздуха
means of control	средства, контроля
submarine	подводная лодка
humidity	влажность
dehumidifying	высушивание
preheat coil	предварительно нагретый змеевик
excess heat	избыток тепла
at least	по крайней мере
per hour	в час
leakage	утечка
to contaminate	загрязнять
removal of air	вывод воздуха
fumes	запахи, испарение, дым
hazardous to health	опасный для здоровья

3. Найдите в словаре и запишите значения следующих слов:

human, purity, fan, crack, additional, complexity, proper, plenty (of), although, to concern, gradually, accompany.

4. Определите по суффиксам, какие на данных слов являются существительными, прилагательными или наречиями; переведите слова:

department, highly, filter, healthful, humidity, suitable, attention, mechanical, important, sufficient, formerly, production, hazardous.

5. Образуйте от следующих глаголов существительные с суффиксами “-ment”, “-tion”, “-ion”:

treat, ventilate, equip, import, add, require, contaminate.

6. Назовите, от каких существительных образованы данные прилагательные:

basic, suitable, industrial, additional, important, special, healthful.

7. Переведите следующие предложения на русский язык, обращая внимание на глагол в страдательном залоге.

1. Air conditioning for human comfort is employed in both large and small installations.

2. The control of air purity can be achieved in various degrees.

3. There are certain industrial processes that are accompanied by the production of air-born dust, fumes, toxic vaporous and gases.

4. At present natural gas is put to large-scale economic use.

5. In homes natural gas is used for cooking, water heating, refrigeration for food.

6. Like all fuels combustible gases are classified according to their heating value.

8. Переведите предложения, обращая внимание на “Infinitive”.

1. The purpose of ventilation is to carry away excess heat and odours.

2. To have healthy living conditions every person should have plenty of fresh air.

3. The leakage of air through cracks in doors and windows is usually sufficient to change air in buildings.

9. Прочитайте и переведите следующий текст.

AIR CONDITIONING. VENTILATION

In our modern world of science and highly developed technology air conditioning is of great significance.

Air conditioning is the treatment of the air in the building to make it more healthful for human comfort or more suitable for industrial processes.

Air conditioning for human comfort is employed in both large and small installations, such as theatres, office buildings, department stores, residences, airplanes, railways, cars and submarines.

All-year air conditioning must provide means for control of temperature, humidity, purity and motion of the air both in summer and winter, and involves not only means for warming and humidifying in winter but also for cooling and dehumidifying in summer. The latter calls for mechanical cooling.

The basic pieces of equipment are the filters, preheat coils, humidifiers, dehumidifiers, reheat coils, additional cooling coils, fans and controls. The control of air purity can be achieved in various degrees.

Air conditioning systems vary in complexity and cost, according to the necessary conditions and the degree of accuracy of control.

As far as ventilation receives proper attention in modern structures, it is a very important factor in house building. The purpose of ventilation is to carry away excess heat and odours.

In order to have healthy living conditions every person in the building should have plenty of fresh air. Any room with people in it requires at least three or four air changes per hour. One air change an hour is not sufficient as that won't keep the percentage of carbon dioxide within reasonable limits. In buildings such as homes, the leakage of air through cracks in doors and window is usually sufficient to meet this requirement. Although ventilation was formerly concerned with the supply of fresh air to and the removal of hot and contaminated air from the space it gradually come to be associated with cleaning of air.

Industrial buildings often present special problems in ventilation. There are certain industrial processes that are accompanied by the production of air-born dust, fumes, toxic vapours and gases which ere hazardous to the health of workers.

10. Подберите соответствующий перевод из правого столбца к данным английским словам:

- | | |
|-----------------|----------------------------|
| 1) to develop | a) процентное соотношение |
| 2) significance | b) установка |
| 3) healthful | c) достаточный |
| 4) comfort | d) значение |
| 5) to employ | i) умеренный |
| 6) installation | f) представлять |
| 7) reasonable | g) утечка |
| 8) sufficient | h) пространство |
| 9) percentage | i) развивать |
| 10) leakage | j) комфорт, удобства |
| 11) space | k) применять, использовать |
| 12) to present | l) здоровый |

11. Укажите, к каким абзацам текста могут служить заголовками данные предложения; расположите их согласно последовательности.

1. The basic parts of equipment for an all-year air conditioning system.
2. Ventilation for industrial buildings.
3. The importance of air conditioning for human comfort.

12. В соответствии с содержанием текста дополните незаконченные предложения одним из данных вариантов.

1. Air conditioning implies ...
 - a) rapid loss of heat;
 - b) provision for the expansion of the water;
 - c) the control of temperature, humidity, paruy and mouon of the air.

2. The purpose of ventilation is ...
 - a) to produce a desired temperature for maintaining comfort;
 - b) to maintain air purity at an extremely high level;
 - c) to carry away excess heat and odours.
3. The basic pieces of air conditioning equipment are ...
 - a) stokers, coal furnaces and boilers;
 - b) filters, preheat coils, humidifiers, reheat coils, fans and controls;
 - c) boilers and a system of pipes.

13. В соответствии с содержанием текста найдите правильные ответы на данные вопросы.

1. What is air conditioning?
 - a) air conditioning is the motion of the air;
 - b) is the treatment of the air in the building;
 - c) is the loss of the heat and odours.
2. What is the purpose of ventilation?
 - a) the purpose of ventilation is to receive proper attention in house-building;
 - b) is to change air as often as possible;
 - c) is to carry away excess heat and odours.

14. Дополните незаконченные предложения необходимыми по смыслу аргументами.

1. Air conditioning involves not only means for warming and humidifying in winter, but ...
2. Ventilation receives proper attention in modern structures because. ..
3. Every person in the building should have plenty of fresh air as ...
4. One air change an hour is not sufficient, as ...

15. Переведите предложение на русский язык.

1. There are some types of air conditioning for different kinds of buildings.
2. Winter air conditioning includes cleaning, heating, humidifying and circulating of air.
3. Summer air conditioning includes cleaning, cooling, dehumidifying and circulating.
4. Complete air conditioning includes both the winter and the summer functions and is used in theaters, large department stores and different office building.

16. Выразите согласие или несогласие в следующих утверждениях, используя следующие выражения:

а) выражения согласия:

Right you are. That's (quite) right; I fully agree with you (in this respect); That's very true; I'm of the same opinion; Yes, of course;

б) выражения несогласия:

That's not quite right; That's not so; I'm afraid you are wrong; Oh, no. Why?

1. Ventilation is a very important factor in modern structure.
2. There was a time when ventilation didn't receive proper attention in house-building, but now it does.
3. Air conditioning is the distribution of air in buildings.
4. Temperature, humidity and air motion are the main factors of air conditioning.
5. In order to have healthy living conditions every person should have plenty of fresh air.
6. Any room with people in it requires no air changes.
7. One air change an hour is not sufficient for people in the building.
8. Air conditioning system is not used in industrial buildings.
9. The control of air purity can be achieved in various degrees.
10. Air conditioning systems don't vary in complexity and cost.

17. Ответьте на следующие вопросы к тексту.

1. What is air-conditioning?
2. What purposes is air conditioning used for?
3. Where is air conditioning used?
4. What do you know about ventilation of buildings?
5. Does ventilation receive proper attention in house buildings?
6. How many air changes per hour should be in the building?
7. Why is one air change an hour not sufficient?

18. Составьте план текста.

19. Перескажите текст по плану не менее чем 6 предложениями на английском языке.

20. Прочтите текст без словаря и найдите ответ на вопрос "What does the term air conditioning mean?"

The term air conditioning has been so widely and loosely used that the students should be careful in trying to understand its true meaning. For many years we have introduced air into buildings after heating, dehumidifying and in some cases, cooling it, and we have called that process ventilation. In recent years much greater stress has been laid on the treatment of air as compared with circulating it merely through the building, and we now call the process air conditioning.

The factors which are of importance in air conditioning are many and unfortunately the term is sometimes used to refer only to minor factors such as cleaning and circulating of air. It is important that the engineer should exactly realize what an air conditioning system does and what it does not do, and what results can be expected from the system.

21. Переведите текст со словарем.

A. The Stockholm TV tower was built with slip form, the concrete being poured at a rate equivalent to a rise of about 12 ft a day. The structure is anchored to bed — rock by 72 prestressed steel rods of 1/4 in. in diameter, buried to depth of about 26 ft.

The ventilation installation comprises 18 separate systems and serves three principal purposes: the ventilation of general 18 areas, the cooling of telecommunications equipment, and the air conditioning of the restaurant. A total of 65 fans and air treatment units are housed in fan rooms on 8 storeys.

В. The cities of Liverpool and Birkenhead are joined by a tunnel which goes under the river. It is one of the greatest underwater tunnels in the world. Its total length is over two and a half miles. From the very start of its construction it was realized that the ventilation of a tunnel of such length, which was to be used vehicles (средства передвижения) propelled by internal combustion, would be a very difficult problem. Finally, a system of ventilation was adopted in which air is blown into the tunnel through ducts at roadway level (трубы, проложенные на уровне дороги) and drawn off (отводится) along the roof through exhausts (выпускные отверстия).

22. Прочтите текст и озаглавьте.

Ventilation on the Moscow Metro is carried out by a very ingenious air-supply system. Millions of cubic meters of pure air are pumped into the stations as a whole factory equipped with powerful pumps and fans is required for the purpose. It is remarkable about the whole ventilation system of the Moscow Metro that all that equipment is completely out of sight. Several Metro stations have automated remote controlled air conditioners and passengers simply take all this for granted.

UNIT 3

1. Прочтите следующие интернациональные слова и найдите их русские значения:

- | | |
|------------------|--------------------------------------|
| 1) modern | a) экономический, выгодный, доходный |
| 2) gas | b) производство, изготовление |
| 3) intensive | c) классифицировать |
| 4) natural | d) газ |
| 5) manufacture | e) интенсивный |
| 6) utilization | f) торговый, коммерческий |
| 7) economic | g) современный, новый |
| 8) refrigeration | h) естественный, натуральный |
| 9) commercial | i) утилизация, использование |
| 10) to classify | j) охлаждение, замораживание |

2. Запомните значения следующих слов и словосочетаний для лучшего понимания текста:

indispensable	совершенно необходимый
modern amenities	современные удобства
exploration	исследование
source of heat	источник тепла
combustible, fuel gases	горючие газы
gas pipeline	газовый трубопровод
gas main	газопровод
water supply pipeline	трубопровод водоснабжения
ramified network	разветвленная сеть
carbon monoxide	окись углерода
hydrogen	водород
sulphide	сульфид, сернистое соединение
poisonous matter	отравляющее вещество
sewer	канализационная труба
distribution and service line	распределительный и служебный трубопровод
careless handling	небрежное обращение
explosion	взрыв
a system of underground municipal utilities	система городских коммунальных сооружений

3. Подберите значения к следующим английским словам:

use	тип
heat	учреждение
amenities	ценность, значение
source	передовой
establishment	тепло
type	источник
value	употребление, применение
advanced	распределение
distribution	удобство

4. Переведите следующие словосочетания:

part of modern amenities; natural gas; at present; large-scale; economic use; source of heat; water heating; heating value; fuel gases; combustible gases; types of fuel; poisonous matter; careless handling; start-up; heat source; ramified network.

5. Определите по суффиксам какие из данных слов являются существительными, а какие — прилагательными; переведите их:

indispensable, amenity, intensive, exploration, natural, manufacture, utilization, economic, economical, convenient, refrigeration, commercial, establishment, combustible, advanced, poisonous, matter, electric, quality.

6. Назовите английские глаголы, от которых образованы следующие существительные; переведите их:

exploration, utilization, use, refrigeration, establishment, handling, intoxication, distribution.

7. Найдите в тексте “Gas Supply” предложение в страдательном залоге; переведите их.

8. Прочтите и переведите текст.

GAS SUPPLY

Gas supply is an indispensable part of modern amenities. Gas supply is widely used now. With an intensive exploration of finding natural gas it has gradually replaced the manufacture in its utilization. At present natural gas is put to large-scale economic use. The main utilization of natural gas is as a clean, convenient, economical source of heat. In homes it is used for cooking, water heating refrigeration for food.

Natural gas supply is used also as a heat source in commercial establishments.

Combustible gases are one of the most advanced types of fuel. Like all fuels combustible gases are classified according to their heating value. Fuel gases contain carbon monoxide, hydrogen, sulphide and highly poisonous matter.

Careless handling of fuel gases may lead to explosions, fires and intoxication.

Cities are provided with a ramified network of water-supply pipelines, sewers, gas pipelines, heat-supply pipelines, electric cables, communication lines and the like. These lines are usually laid under streets, forming a system of underground municipal utilities.

Gas system consists of gas main, distribution and service line.

The construction of gas pipelines should be checked for quality at all stages, especially before start-up.

Note to the text

and the like

и тому подобное

9. К каждой данной паре слов подберите русское слово с тем корнем, что и английское слово:

Образец: natural — естественный (натуральный).

a) modern — современный, новый (...);

b) intensive — напряженный (...);

c) manufacture — производство, изготовление (...);

d) utilization — использование (...);

i) economic — выгодный (...);

f) communication — связь, сообщение (...);

g) municipal — городской (...);

h) construction — строительство (...).

10. Укажите, к каким абзацам текста могут служить заголовками данные предложения; расположите их согласно последовательности изложения.

1. A system of underground utilities.

2. The use of gas supply.

3. The properties of combustible gases.

11. Сгруппируйте следующие предложения по данным темам:

a) heating;

b) air conditioning;

c) ventilation;

d) gas supply.

1. Natural gas supply is used also as a heat sources in commercial establishments.

2. In industrial buildings three types of ventilation are in use so as to control dangerous gases and dusts.

3. Heating in Moscow and in other cities costs the inhabitants very, very little.

4. As for the purpose air-conditioning system may be described as winter, summer and all-year.

5. Gas supply has come to be very widely used.

6. In buildings such as homes, the leakage of air through cracks in doors and windows is usually sufficient.

7. The main utilization of natural gas is as a clean, convenient, economical source of heat.

8. Certain industrial process requirements and human comfort are the two major factors to be considered when designing an air-conditioning system.

9. The main purpose of ventilation is to carry away excess heat and odours.

10. Nearly all the flats have central heating.

11. Rules have been established for the testing and acceptance of gas mains and pipelines in cities and industrial plants.

12. Houses heated by stores are found on the outskirts of the city.

13. There are two kinds of combustible gases — naturally occurring and manufactured.

14. Air conditioning is meant for the control of temperature, humidity, purity and motion of the air in an enclosure.

12. Восстановите по памяти (на русском языке), в каком контексте упоминаются следующие английские словосочетания.

1. ... may lead to explosions, fires and intoxication.

2. ... are classified according to their heating value.

3. ... and highly poisonous matter.

13. Выразите согласие или несогласие следующих утверждений. Используя выражения:

As far as I know; Properly speaking; It goes without saying; Don't you know?; If I'm not mistaken; Oh, no. Indeed no; By the way.

1. Combustible gases are used in domestic and industrial installations.

2. Combustible gases are one of the most advanced types of fuel.

3. Combustible gases are used instead of ventilation.

4. Fuel gases contain carbon monoxide.

5. There are many kinds of combustible gases.

6. Air conditioning and gas supply are very closely connected.

14. Ответьте на вопросы.

1. What do fuel gases contain?

2. What may lead to explosions?

3. Where is gas supply used?

4. What is gas supply used for?

5. What does gas system consist of?

15. Переведите на английский язык.

1. Газ — неотъемлемая часть современных удобств.

2. Природный газ используется как чистый, удобный и экономичный источник тепла.

3. Горючие газы — очень выгодное топливо.
4. Горючие газы классифицируются согласно своим тепловым ценностям и состоят из нескольких газов.
5. Небрежное обращение с горючими газами очень опасно.
6. Газовый трубопровод прокладывается под улицами городов.
7. Система газоснабжения состоит из основной магистрали, распределительных и служебных труб.
8. Строительство газового трубопровода должно контролироваться согласно правилам на всех стадиях.

16. Перескажите текст “Gas Supply”.

ADDITIONAL MATERIAL FOR HOME-READING

SOLAR HEATING SYSTEMS

Sunshine can be converted directly into heat. In this form it has several advantages over conventional fuels: it is clean; it is nonpolluting; and it is virtually inexhaustible. However it is also intermittent. Thus one big difference between solar heating systems and conventional ones is the necessity of storing energy in the form of heat.

A suitable heat-storage tank should maintain desired levels of temperature for 2 consecutive days without direct sunlight when the heat supply cannot be replenished.

In solar heating systems, the principles of operation are simple. Solar collectors are situated where they will have maximum exposure to sunlight. A dark surface inside the collector absorbs the solar radiation and converts it to heat. Retention of this heat is made easier by a natural phenomenon known as “green house effect”. Radiation which passes easily through glass or clear plastic in the form of light cannot pass back out in the form of heat, because the wavelength is much longer. It is thus trapped. A fluid (for example, air and water) passed through the collectors transfers this heat either to fulfil an immediate demand or to be stored for later use. Flat plate solar collectors are the most common. They are easy to install. They can also function to some extent even on days that are overcast. Stationary collectors are usually installed on a south-facing wall or roof and inclined to take best advantage of the winter sun, which is very low in the sky. For optimum performance, the collectors should be inclined above the horizon at an angle equal to the local latitude plus 10 degrees.

Heat is captured better in collectors with a second cover. This is especially important where heat loss is a serious problem. In general, the better insulated double-glazed collectors are recommended for cold northern climates, but single-glazed ones are perfectly adequate for warm climates.

All collectors have insulating material along the underside, but those intended for use in cold climates should be especially well protected against heat loss to the building or the environment.

In south countries specialists design and build solar power systems for shepherd's homes. It makes life and work more comfortable for shepherds and agricultural workers who have to spend long spells in the desert. With the aid of solar power system people in the desert are able to use a television and other electric appliances.

HEATING. VENTILATING. CONDITIONING

Heating. There are many different types of standard heating systems. Central heating is often used in cold climates to heat private houses and public buildings. Such a system contains a boiler, furnace, or heat pump to heat water, steam, or air, all in a central location such as a furnace room in a home. Water is often used as the heat transfer medium. The system also contains either ductwork, for forced air systems, or piping to distribute a heated fluid in radiators to transfer this heat to the air. The term radiator in this context is misleading since most heat transfer from the heat exchanger is by convection, not radiation. The radiators may be mounted on walls or buried in the floor to give floor heat.

At all systems of heating except the simplest systems have a pump to circulate the water and ensure an equal supply of heat to all the radiators. The heated water can also be fed through another heat exchanger inside a storage cylinder to provide hot running water.

Forced air systems send heated air through ductwork. During warm weather the same ductwork can be used for air conditioning. The forced air can also be filtered or put through air cleaners.

Heating can also be provided from electric, or resistance heating using a filament that becomes hot when electric current is caused to pass through it. This type of heat can be found in electric baseboard heaters, portable electric heaters, and as backup or supplemental heating for heat pump (or reverse heating) system.

The heating elements (radiators or vents) should be located in the coldest part of the room, typically next to the windows to minimize condensation and offset the convective air current formed in the room due to the air next to the window becoming negatively buoyant due to the cold glass. Cold air drafts can contribute significantly to subjectively feeling colder than the average room temperature. Therefore, it is important to control the air leaks from outside in addition to proper design of the heating system.

The invention of central heating is often used by the ancient Romans, who installed a system of air ducts called a hypocaust in the walls and floors of public baths and private villas.

Ventilating. Ventilating is the process of “changing” or replacing air in any space to control temperature or remove moisture, odors, smoke, heat, dust, bacteria, carbon dioxide, and to replenish oxygen. Ventilation includes both the exchange of air to the outside as well as circulation of air within the building. It is one of the most important factors for maintaining acceptable indoor air quality in buildings. Methods for ventilating a building may be divided into mechanical/forced and natural types. Ventilation is used to remove unpleasant smells and excessive moisture, introduce outside air, to keep interior building air circulating, and to prevent stagnation of the interior air.

Mechanical or forced ventilation. “Mechanical” or “forced” ventilation is provided by an air handler and used to control indoor air quality. Excess humidity,

odors, and contaminants can often be controlled via dilution or replacement with outside air. However, in humid climates much energy is required to remove excess moisture from ventilation air.

Kitchens and bathrooms typically have mechanical exhaust to control odors and sometimes humidity. Factors in the design of such systems include the flow rate (which is a function of the fan speed and exhaust vent size) and noise level. If ducting for the fans traverse unheated space (e.g., an attic), the ducting should be insulated as well to prevent condensation on the ducting.

Ceiling fans and table/floor fans circulate air within a room for the purpose of reducing the perceived temperature because of evaporation of perspiration on the skin of the occupants. Because hot air rises, ceiling fans may be used to keep a room warmer in the winter by circulating the warm stratified air from the ceiling to the floor. Ceiling fans do not provide ventilation as defined as the introduction of outside air.

Natural ventilation. Natural ventilation is the ventilation of a building with outside air without the use of a fan or other mechanical system. It can be achieved with openable windows or trickle vents when the spaces to ventilate are. In more complex systems warm air in the building can be allowed to rise and flow out upper openings to the outside (stack effect) thus forcing cool outside air to be drawn into the building naturally through openings in the lower areas. These systems use very little energy but care must be taken to ensure the occupants' comfort. In warm or humid months, in many climates, maintaining thermal comfort solely via natural ventilation may be so conventional air conditioning systems are used as backups. Air-side economizers perform the same function as natural ventilation, but use mechanical systems' fans, ducts, dampers, and control systems to introduce and distribute cool outdoor air when appropriate.

Air conditioning. Air conditioning and refrigeration are provided through the removal of heat. The definition of cold is the absence of heat and all air conditioning systems work on this basic principle. Heat can be removed through the process of radiation, convection, and Heat cooling through a process called the refrigeration cycle. The conduction mediums such as water, air, ice, and chemicals are referred to as refrigerants.

An air conditioning system, or a standalone air conditioner, provides cooling, ventilation, and humidity control for all or part of a house or building.

The refrigerant cycle consists of four essential elements to create a cooling effect. The system refrigerant starts its cycle in a gaseous state. The compressor pumps the refrigerant gas up to a high pressure and temperature. From there it enters a heat exchanger (sometimes called a "condensing coil") where it loses energy (heat) to the outside. In the process the refrigerant condenses into a liquid. The liquid refrigerant is returned indoors to another heat exchanger ("evaporating coil"). A metering device allows the liquid to flow in at a low pressure at the proper rate. As the liquid refrigerant evaporates it absorbs energy (heat) from the inside air, returns to the compressor, and the cycle repeats. In the process, heat is absorbed from indoors, and transferred outdoors, resulting in cooling of the building.

Central, “all-air” air conditioning systems are often installed in modern residences, offices, and public buildings, but are difficult to retrofit because of the bulky air ducts required. A duct system must be carefully maintained to prevent the growth of pathogenic bacteria in the ducts. An alternative to large ducts to carry the needed air to heat or cool an area is the use of split systems. These systems, although most often seen in residential applications, are gaining popularity in small commercial buildings. The evaporator coil is connected to a remote condenser unit using piping instead of ducts.

Dehumidification in an air conditioning system is provided by the evaporator. Since the evaporator operates at a temperature below dew point, moisture in the air condenses on the evaporator coil tubes. This moisture is collected at the bottom of the evaporator in a condensate pan and is removed by piping it to a central drain or onto the ground outside. A dehumidifier is an air-conditioner-like device that controls the humidity of a room or building. It is often employed in basements which have a higher relative humidity because of their lower temperature (and propensity for damp floors and walls).

All modern air conditioning systems, down to small “window” units, are equipped with internal air filters. These are generally of a light weight gauze-type element, and must be replaced as conditions warrant (some models may be washable). For example, a building in a high-dust environment, or a home with furry pets, will need to have the filters changed more often than buildings without these dirt loads. Failure to replace these filters as needed will contribute to a lower heat-exchange rate, resulting in wasted energy, shortened equipment life, and higher energy bills; also low air flow can result in “iced-up” or “iced-over” evaporator coils, and then there is no air flow at all. Additionally, very dirty or plugged filters can cause overheating during a heating cycle, and can possibly result in damage to the furnace unit or even fire.

It is important to keep in mind that because an air conditioner moves heat from the indoor (evaporator) coil to the outdoor (condenser) coil, the latter must be kept just as clean as the former. This means that, in addition to replacing the air filter at the evaporator coil, it is also necessary to regularly clean the condenser coil. Failure to keep the condenser clean will eventually result in harm to the compressor, because the condenser coil is responsible for discharging both the indoor heat (as picked up by the evaporator) plus the heat generated by the electric motor driving the compressor.

Outside, “fresh” air is generally drawn into the system by a vent into the evaporator section. Adjustment of the percentage of return air made up of fresh air can usually be adjusted by manipulating the opening of this vent.

DIFFERENT METHODS OF HEATING AND VENTILATION

Various methods of heating have been evolved and are in use at the present day, and a knowledge of the characteristics and relative costs is necessary in making a selection of the most suitable type for any particular building.

There are two main divisions of heating systems: direct and indirect.

Direct systems are those in which the fuel is consumed in the room to be heated.

Indirect systems are those in which the fuel is consumed outside the room, the heat being conveyed to the room by a medium such as steam or hot water.

Direct systems. Direct systems are chiefly used for intermittent heating, or for heating isolated rooms. They may be summarized thus: open fires, burning coal or coke; slow combustion stoves, burning coke or anthracite; gas fires; gas convectors; electric fires; electric convectors.

There are many other forms of Direct Heating, such as gas and electric overhead radiant heaters, in which a metallic plate is heated to a high temperature so as to emit strong heat radiation; and electric unit heaters in which air is delivered to the room by a fan and is warmed in its passage through the unit by heated elements. There are also low-temperature gas and electric radiant panels for fixing to walls, ceilings, etc., also electric tubular heaters for fixing near skirting level. These systems are generally more expensive in first cost than those enumerated above.

Indirect systems. Indirect systems are chiefly used for the continuous heating of a number of rooms or large buildings from one central source, hence the name Central Heating. This does not necessarily imply that the heating source is strictly central, indeed it may be at a considerable distance from the building.

This class of system finds its greatest application in large buildings of all types.

The advantages of the Indirect System are:

- 1) fuel and ashes are kept outside the occupied spaces;
- 2) individual fuels are not required;
- 3) cleanliness;
- 4) equable temperature maintained in all parts, easily controlled automatically.

The disadvantages are:

1. Heat is lost from main piping where this is outside the occupied rooms. This loss can be minimized by proper insulation of the pipes.

2. Labour is required for stoking and removal of ashes. This applies only with solid fuel and can be greatly reduced with automatic firing.

3. The medium employed for the transmission of heat is either steam, hot water, or heated air.

Steam. In this system steam is generated in a boiler partly filled with water, and the steam is conveyed through pipes to radiators, unit heaters, etc., in the rooms to be heated. The steam is herein condensed into water which is preferably returned to the boiler through a system of return piping.

The advantages of steam are — low heat capacity, hence quick heating up and cooling down; low cost due to high temperature of heating surfaces.

VENTILATION AND WATER HEATING

Adequate ventilation of buildings has received increased attention during the last few years. Low ceilings, small window areas, back-to-back houses, and excessive densities are things of the past, and now every endeavour is made to ensure a free circulation of air about buildings for the purpose of efficient ventilation.

Building bylaws prescribe the minimum heights of rooms and amount of open space to be provided in the front and rear of every building. The size of windows is controlled by the floor area of each room, and usually windows in habitable rooms should be equal to at least one-tenth of floor area. Rooms without fireplaces are to be ventilated to take the place of the chimney flue, which is usually regarded as a good ventilator. Another important clause controls the minimum heights of rooms.

It will be seen, however, that the building bylaws in this respect are useless unless some control is exercised over the grouping of building units. It is absurd to insist on suitable means of ventilation if it is permissible to construct buildings close to one another, thereby impeding the circulation of fresh air. It is now impossible to crowd dwellings together and consequently the byelaws with regard to ventilation have greater significance.

The constituents are mainly nitrogen and oxygen and suitable means have to be adopted to ensure a constant supply of air of this composition for the maintenance of life.

From experience it is found that approximately 3,000 cu. ft. of per person per hour is required in enclosed spaces in order to maintain healthy conditions. This figure forms a basis for calculating the size of efficient mechanical ventilating schemes.

Natural ventilation. Small domestic buildings, offices, hotels, and other places with small floor areas are ventilated by natural means depending largely upon the provision of suitable inlets and outlets. The fittings used are too well known to set down in detail, but briefly they comprise: windows, lantern lights with sides to open, fan-lights, hopper sashes, revolving cowls, draught window boards, valves and air vents, "hit and miss" ventilation, tobac pipe inlets, fireplaces, doors, electric fans, etc.

With regard to the tobac pipe care should be taken to see that this fitting receives attention, otherwise after a number of years the receptacle may be found full of filth owing to misuse. It is not unusual for careless people to deposit cigarette-ends, waste paper, etc., into the open ends of the ventilator. The usual height of 5 ft. to 6 ft. is convenient for this misuse, particularly as few people realise their real purpose.

This type of ventilator is used mostly in public buildings, church halls, billiard halls, etc., and can be quite efficient if given periodic attention.

Natural ventilation has the advantage of being cheap to install, and provides healthy and stimulating conditions, provided the inlets and outlets have been designed with skill.

Artificial ventilation. In the case of large floor areas, such as we have in design for theatres, factories, large public halls, and other similar buildings, it is necessary to resort to artificial ventilation.

Vacuum ventilation. This is a system of ventilation whereby the internal air is extracted by suitable fans. The incoming air is induced through windows and other similar inlets already described for natural ventilation, and a steady flow of air is maintained by means of the extraction fans.

Fans are usually driven by electric motors, but other power may be utilised where electricity is not available.

With the vacuum ventilating system there is no control of the incoming air; therefore this system can only be employed successfully where the surroundings are not noisy and windows can be opened to admit clean air.

Plenum ventilation. Control over the incoming air is an important feature of this type of ventilation. Where the conditions are such that the surroundings are noisy and the air is fouled by smoke and dust, the plenum system can be contemplated to provide clean air at the correct temperature and humidity. The air is drawn into the building by a fan, and is discharged through ductwork at suitable positions; conveniently placed outlets abstract the vitiated air through ducts controlled by an extraction fan of smaller power than the inlet fan. A slight pressure is created owing to a large rate of incoming air than that which is extracted, and consequently any leakage must be outwards.

The plenum system of ventilation is costly to install, owing to the necessity for expensive apparatus consisting of propulsion and extraction fans, air heaters, washers and filters (these vary according to circumstances), and distributing ductwork for the incoming air and outgoing air.

A typical arrangement of plenum heating suitable for a large auditorium is as follows: The air coming in is heated by a heater battery, fed from an independent boiler, feeding wrought-iron gilled tubes which have a good radiating surface. In summer, however, the air can be cooled by passing through the same battery fed by an ammonia refrigerating plant supplying cold water instead of hot water from the boiler.

From the foregoing description it will be seen that the plenum system complicated and needs skilled attention for maintenance. The system must be frequently examined, otherwise a breakdown has serious consequences. For this reason it is advisable to duplicate the fans.

Hot water supply to buildings. For domestic purposes the water is generally heated by means of a boiler at the back of a fireplace or by an independent boiler in the kitchen, burning coke or other suitable fuel.

Tank and cylinder systems. A typical system installed in a small house with the well-known "boot boiler" is shown in 12 ft. This type of range boiler is economical and thoroughly efficient. Sometimes two boilers are interconnected, one behind the kitchen range and the other in the living-room or elsewhere. This arrangement has the advantage of supplying hot water irrespective of which fire is in use. An independent boiler is nowadays frequently specified in place of the kitchen-range type.

Distributing mains. The distributing mains generally extend along the streets, and are laid deep enough to avoid injury from frost and heavy traffic.

The mains vary in size. They are usually of an internal diameter of 4 in. and upwards, and made of cast iron with caulked-lead joints or flanged joints. The caulked-lead socket and spigot joint is still extensively used for cast-iron mains of all descriptions. Occasionally, however, it is advantageous to use flexible joints which permit movement between adjacent pipes sufficient to enable bends to be negotiated without the use of specials.

Asbestos-cement pressure pipes are also popular and are generally accepted for water mains and extensions.

Type of supply. The water supply may be intermittent or constant, usually the latter, whereby the mains are always full of water. By a constant system is meant a system whereby the mains are constantly under pressure. The drinking water is taken direct from the rising main, and consequently it is only necessary to provide a small storage system sufficient for the hot water supply. In cases where the water is turned off periodically, the system is known as the intermittent supply. In this system, large storage tanks are necessary for the water, which is supplied for a short period each day.

The constant system has the following advantages over the intermittent supply:

1. The mains are always full and an adequate supply of water may be obtained at any time.

2. The danger of drinking water becoming contaminated is lessened owing to a direct supply from the main and the avoidance of large storage cisterns.

3. The pipes, constantly under pressure, are less liable to deteriorate. With the intermittent supply, a vacuum may be created causing a strain on the pipe joints which may lead to gradual leakage.

4. In order to maintain a good fire-fighting service, a constant supply is necessary for the fire hydrants. An abundant supply of water can be obtained in the case of fire.

The chief advantage of the intermittent supply is the saving of water, but the constant system is usually preferred.

Service pipes. The service or supply pipe may be lead, copper, wrought iron, or steel. Lead pipes are extensively used, and the weight in proportion to the diameter will vary slightly in accordance with the regulations of the water authorities.

Copper pipes are permitted for use inside premises subject to the gauge complying with water company's regulations. Such pipes are simple to fix and have a neat appearance.

There are three grades of iron pipes, known as "gas", "water" and "steam" strengths, and for water supplies the steam quality should be specified.

Whatever type of service pipe is laid, it should be at a reasonable depth below the surface of the ground, usually not less than 2 ft. 6 in., to guard against the effects of frost. In addition, any part of the pipe which may be in an exposed situation should be properly protected.

Having excavated the ground to the required depth and exposed the water main, the next step is to apply to the water company, who will make the actual connection by supplying and fixing a ferrule for the connection.

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