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PROFESSIONAL ORIENTED FOREIGN LANGUAGE

Methodological instructions for students of specialty
5B071700 – Heat Power Engineering
for practical study and development of reading and translating skills

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The present methodological guidelines are intended for students of specialty Heat Power Engineering.

Special attention is drawn to the translation of authentic professional texts, compilation of terminological vocabulary, as well as doing lexical and grammar exercises.

Reviewer: L.D. Sergeeva

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Introduction

The present methodological guidelines are intended for students of specialty Heat Power Engineering. They might be used in class with a teacher as well as a self-study book. It is not necessary to read all the texts in order. If you know what aspects you have difficulty with, go straight to the texts that deal with them, using the Contents to help you find the relevant text. You can use the texts in a number of ways. You can just read the text and translate it with a vocabulary below. On the other hand, if the text is not difficult for you it is not necessary to search for the words in vocabulary, but to do the exercises instead, for better understanding of the text. Students have a chance to get acquainted with the history of development of the telephone from its early simplest stage till the modern inventions of nowadays. They will follow all these periods step by step. Finding the names of great inventors and their contribution to science and modernization. All the main themes of this specialty are covered here with the information from up-to-date sources available.

Unit1. General Aspects of Heat Power Engineering

Grammar: Simple Present. Active and Passive.

1. Memorize the following words and word combinations:

Shale	Furnace
Fossil fuel	Waste
Burn	Carbon dioxide
Solid	Groundwater
Liquid	Hotbed
Peat	Household
Firewood	Exhaust gases
Combustion	Conserve
Lump	

Exercise 1. Read and translate the text.

General Aspects of Heat Power Engineering

The principal sources of heat today are the fossil fuels, which give off heat when burned. These fuels may be solid, liquid, or gaseous. Among the more common solid fuels are coals (lignite's, anthracites), combustible shales, and peat. Petroleum is a natural liquid fuel, but it is seldom used directly to produce heat. Instead, it is refined to produce gasoline for automotive and piston aircraft engines, kerosene for jet engines and certain types of piston engines, and various types of diesel fuel and mazut, used chiefly in nonnuclear thermal power plants. The most important gaseous fuel is natural gas, which consists of methane and other hydrocarbons. On a smaller scale, wood (firewood, scrap wood) also serves as a fuel. Methods are now being developed to burn industrial and domestic waste materials for purposes of both disposal and heat generation.

Various types of apparatus, such as furnaces, stoves, and combustion chambers, are used for fuel combustion. Fuel is burned in furnaces and stoves at a pressure close to atmospheric with air as the oxidizing agent. In combustion chambers, the pressure may be higher than atmospheric and oxygen air or air enriched with oxygen may serve as the oxidant.

Coal is usually burned in furnaces. For burning larger quantities of coal chamber furnaces are used. Mazut furnaces and gas furnaces are similar to pulverized coal furnaces but they have different burner and nozzle designs.

In addition to organic and nuclear fuels, geothermal and solar energy have been found to have practical value in heat generation. Geothermal energy manifests itself in hot groundwater, which often comes to the surface in regions of volcanic activity and in the general temperature increase with depth inside the earth. While

the heat from hot springs is already being put to use, the possibility of using heat from the earth's interior is as yet only being studied.

The sun is a tremendous source of heat. However, the density of solar energy at earth's surface is low. Systems and equipment for collecting solar radiation on a large scale that meet both technical and economic requirements are now being developed. And in many regions solar energy is being used to distill water and to heat water for agricultural (hotbeds, greenhouses) and household needs; in some cases, it is used in the production of electric power.

Of great importance in view of need to conserve natural fuels is the use of secondary heat sources. These sources include the hot exhaust gases of metallurgical furnaces or internal-combustion engines whose heat is utilized in waste-heat boilers.

Exercise 2. Answer the questions

1.What are the principal sources of heat today?
2.What common solid fuels do you know?
3.What is the important gaseous fuel?
4.How is fuel burned in furnaces and stoves?
5.When are chamber furnaces used?
6.What are secondary heat sources?

Exercise 3. Give the Russian equivalents.

The principal sources; solid; liquid; or gaseous fuels; combustible shales; to produce heat; piston aircraft engines; nonnuclear thermal power plants; industrial waste materials combustion chambers; a pressure close to atmospheric

Exercise 4. Complete the sentences.

1... is refined to produce gasoline for automotive and piston aircraft engines …

2. Methods are now being developed….
3. In combustion chambers … serve as the oxidant.
4…. are similar to pulverized coal furnaces but have different ….
5. Systems and equipment for collecting solar radiation….

Unit 2. Heating Effect of an Electric Current

Grammar: Passive voice.

Exercise 1: Read and translate the text.

Heating effect of an electric current

The production of heat is perhaps the most familiar among principal effects of an electric current, either because of its development in the filaments of the electric lamps or, maybe, because of the possible danger from overloaded wires.

A metal wire carrying a current will almost always be at a higher temperature than the temperature of that very wire unless it carries any current. It means than an electric current passing along a wire will heat that wire and may even cause it to become red-hot. Thus, the current can be detected by the heat developed provided it flows along the wire.

The heat produced per second depends both upon the resistance of the conductor and upon the amount of current carried through it. As a matter of fact, if some current flowed along a thin wire and then the same amount of current were sent through a thicker one, a different amount of heat would be developed in both wires. When the current is sent through the wire which is too thin to carry it freely, then more electric energy will be converted into heat than in the case of a thick wire conducting a small current.

Imagine that a small current is flowing along a thick metal conductor. Under such conditions the only way to discover whether heat has been developed is to make use of a sensitive thermometer because the heating is too negligible to be detected by other means. If, however, the conductor were very thin while the current were large the amount of generated heat would be much greater than that produced in the thick wire. In fact, one could easily feel it. Thus the thinner the wire, the greater the developed heat. On the contrary, the larger the wire, the more negligible is the heat produced.

Needless to say, such heat is greatly desirable at times but at other times it must be removed or, at least, decreased as it represents a waste of useful energy. In case heat is developed in a transmission line, a generator or a motor, it is but a waste of electric energy and overheating is most undesirable and even dangerous. This waste is generally called “heat loss” for it serves no useful purposes and does decrease efficiency. Nevertheless, one should not forget that the heat developed in the electric circuit is of great practical importance for heating, lighting and other purposes. Owing to it people are provided with a large number of appliances, such as: electric lamps that light homes, factories, electric heaters that are widely used to meet industrial requirements, and some other necessary and irreplaceable things which have been serving mankind for so many years.

In short, many other of the invaluable electrical appliances without which life would seem strange and impossible at present can be utilized only because they transform electric energy into heat.

The production of heat by an electric current is called heating effect. One might also name its light effect provided the heat in the conductor is great enough to make it white-hot, so that it gives off light as well as heat. Take the filament of an electric lamp as an example. It is known to glow because of heat. By the way, were people able to look inside a hot electric iron, they should see that its wires were glowing too. A similar statement could be applied as well to almost any electric heating device. All of them give off a little light a lot of heat.

Exercise 2: Vocabulary exercises

1.Memorize the following words and word combinations:

- an overloaded wire;
- to heat a wire;
- resistance;
- an electrical heater;
- industrial requirement;
- on the contrary;
- a waste of electric energy;
- heat loss;
- an electric heating device;
- a similar statement;
- to give off a little light;
- electric circuit.

2.Match the words from the left column with the words from the right column and make up sentences:

1.principal	1.effect
2.overloaded	2.lamp
3.metal	3.statement
4.sensitive	4.thermometer
5.transmission	5.wires
6.heat	6.conductor
7.practical	7.loss
8.electrical	8.heater
9.industrial	9.effect
10.heating	10.requirements
11.electric	11.importance
12.similar	12.line

1.A waste of electric energy is usually named … … .

2.It is a waste of electric energy when heat is developed in … … .

3.Heat developed in the … … is of great practical importance for heating purposes.

4.The production of heat is the most familiar among the … … of an electric current.

5.The production of heat by an electric current is called … … .

Exercise 3: Grammar exercises

A.Complete the sentences using the correct voice

1.The heat produced per second (depends, is depended) both upon the resistance of the conductor and upon the amount of current carried through it.

2. When the current (sends, is sent) through the wire which (are, is) too thin to carry it freely, then more electric energy (will convert, will be converted) into heat than in the case of a thick wire conducting a small current.

3. In case heat (am, is) developed in a transmission line, a generator or a motor, it (will, is) but a waste of electric energy and overheating (was, is) most under desirable and even dangerous.

4. A metal wire carrying a current (would almost always be, will almost always be) at a higher temperature than the temperature of that very wire unless it (is carried, carries) any current.

5. The production of heat by an electric current (are, is) called heating effect.

B.Complete sentences with the prepositions: into, in, of, of, for, without, at

1. More electric energy will be converted … heat than … the case … a thick wire conducting a small current.

2. … the contrary, the larger the wire, the more negligible is the heat produced.

3. The heat developed … the electric circuit is … great importance … heating, lightning and other purposes.

4. Many … the invaluable electrical appliances … which life would seem strange and impossible … present can be utilized only because they transform electric energy … heat.

Exercise 4: Give the translation of the following words and word combinations:

нить накала; накалиться докрасна; тонкий, толстый провод; свободно; преобразовывать в; металлический провод; точный, чувствительный термометр; незначительный; другим способом; не говоря уже о; в одном случае, в другом случае; представлять; тем не менее; электрическая цепь; незаменимый; бесчисленный; раскаленный добела; светиться; выделить немного света.

Exercise 5: Circle the letter on the best answer.

1.A metal wire carrying a current will almost always be at

a) a higher temperature

b) 0 degrees

c) a low temperature

2.An electric current passing along a wire --------- that wire.

a) will heat

b) will cool

c) will damage

3.An electric current passing along a wire may cause it to become ------- .

a) cool

b) red-hot

c) long

4.The only way to discover whether heat has been developed is to make use of a ---a) sensitive scales

b) sensitive thermometer

c) sensitive film

5. A waste of energy is called ---------

a) ”hot loss”

b) “heat loss”

c)” lost loss”

Exercise 6: One word in each sentence is wrong. Find the word and correct it.

1.If some current flowed along a thin wire and then the same amount of current were sent through a thicker one, a same amount of heat would be developed in both wires.

2. When the current is sent through the wire which is too thin to carry it freely, then less electric energy will be converted into heat than in the case of a thick wire conducting a small current.

3. The production of heat by an electric current is called heating loss.

Exercise 7:. Give answers to these questions:

1. What happens with a wire if it carries current?

2. What does the heat developed while current flowing through the wire depend on?

3. What happens when the current is sent through the wire which is too thin to carry it freely?

4. How is it possible to discover whether heat is developed?

5. How is it called when heat is developed in a transmission line?

6. Why is a waste of electric energy called “heat loss”?

7. What do invaluable electrical appliances do without which life would seem strange and impossible.

Exercise 8:. Give short summary of the text. Supplementary text for discussion

My future specialty

My future specialty is heat power engineering. We use heat to do a lot of useful things to heat our homes, to transport us from one place to another and so on. Scientists and specialists of our country made great contribution to the development of this branch of energetics.

The present thermal power stations are not ecologically pure. So scientists try to replace the conventional fuel (gas, oil, coal) with adequate one such as tidal energy, wind energy, solar energy which have no environmental pollution effect. It is planned to construct an experimental thermal power station powered by hot subterranean water. The hot subterranean water is now being used for heating blocks of flats and hothouses and for medical purposes in Kamchatka, for instance.

The time is not far off when this cheap thermal energy will be widely used in the economy making possible to employ such valuable raw materials as coal, oil, gas mainly in the chemical industry.

The main task facing heat power engineers is to increase many times the capacity of the thermal power plants and to equip them with high-capacity heat-engineering units.

Unit 3. A Heat Pump System

Grammar: Gerund.

Exercise 1: Read and translate the text and do some exercises after it.

A Heat Pump System

In HVAC (heating, ventilation and air conditioning) applications, a heat pump normally refers to a vapor compression refrigeration device that includes a reversing valve and optimized heat exchangers so that the direction of heat flow may be reversed. The reversing valve switches the direction of refrigerant through the cycle and therefor the heat pump may deliver either heating or cooling to a building. In the cooler climates the default setting of the reversing valve is heating. The default setting in warmer climates is cooling. Because the two the two heat exchangers, the condenser and evaporator, must swap functions, they are optimized the perform adequately in both modes. As such, the efficiency of a reversible heat pump is typically slightly less than two separately-optimized machines. In plumbing applications, a heat pump is sometimes used to heat or preheat water for swimming pools or domestic water heaters. In somewhat rare applications, both the heat extraction and addition capabilities of a single heat pump can be useful and typically results in very effective use of the input energy. For example, when an air cooling need can be matched to a water heating load, a single heat pump can serve two useful purposes. Unfortunately, these situations are rare because the demand profiles for heating and cooling are often significantly different.

Assignments

Exercise 2: Fill in the gaps putting down the words from the brackets in a proper form.

1. A heat pump is a machine or device that ____ heat from one location (the sources) to another. (move)
2. A heat pump normally _____ to a vapor compression device. (refer)
3. A heat engine ___ energy to flow from a hot 'source' to a cold heat 'sink'. (allow)
4. The refrigerant then ___ to the compressor and the cycle is repeated. (return)
5. The reversing valve____ the direction of refrigerant through the cycle. (switch)

6. The condensed refrigerant then ___ through a pressure-lowering device. (pass)

Exercise 3: Word study (Verbs and related nouns).
Form new words with the suffix –or,- er. E.g. refrigerate – refrigerator.
Condense, compress, exchange, evaporate, operate, radiate, freeze.

Exercise 4: Tick the sentences true (T) or false (F).
1. A heat pump is a machine or device that moves heat from one location (the ’source’) to another location.
2. Most heat pump technology doesn’t move heat from a low temperature heat source to a higher temperature heat sink.
3. Heat pumps can be thought of as a heat engine which isn’t operating in reverse.
4. One common type of heat pump works by exploiting the chemical properties of an evaporating and condescending fluid.
5. In heating, ventilation and cooling applications, a heat pump normally refers to a vapor compression device.
6. Most commonly, heat pumps draw heat from the air or from the ground.
7. A heat pump requires work to move thermal energy from a cold source to a warmer heat sink.
8. The heat pump uses a certain amount of work to move the heat.

Exercise 5: Answer the questions.
1. What is the heat pump?
2. What sphere is it widely used?
3. What is the operation of the heat pump?

Unit 4. Types of Heating Systems

Grammar: Modal Verbs
Exercise 1: Read and translate the text.

Types of Heating Systems

All climate-control devices or systems have three basic components: a source of warmed or cooled air, a means of distributing the air to the rooms being heated or cooled, and a control used to regulate the system. A variety of technologies are available for heating your house:

In a central heating system a furnace or boiler consumes the fuel (gas, oil, or electricity) that powers it. As fuel is burned, pipes take hot water to radiators. You get hot water at the same time as heating, depending on how you set the controls.

Electric heat pumps remove heat from outdoor air, ground, surface water or the earth and move heat from one place to another. They can also be used as air

conditioners when the weather is warm. The thermostat will also include controls for air conditioning.

Radiant skirting board heaters are long, metal units with electrical elements inside. They are sometimes the only source of heat in a house, or they can be an extra heating device in cooler rooms.

Radiant ceiling or floor systems are installed in floors, ceilings or (occasionally) walls. They warm objects in much the same way as the sun does.

In hydronic heating a boiler warms the circulating water and hot water flows through tubes under the floor or through units that are similar to skirting board heaters. They can also be installed in ceilings. They are sometimes used under concrete in driveways to keep snow and ice from accumulating.

Portable space heaters are either freestanding or attached to a wall and work with electricity, gas. Their area cannot be qualified as heated living space.

Exercise 2: Answer the following questions:

1. How many and what components do all climate-control devices or systems have?
2. What variety of technologies available for heating your house can you point out?
3. What device can also be used as air conditioner when the weather is warm?
4. Where can hydronic heating be used?
5. What are portable space heaters?
6. What heating system would you personally prefer to install in your house or flat and why?

Exercise 3: Fill in the gaps.

Driveway, radiator, insulation, concrete, portable, stairwell

1. The act of protecting something with a material that prevents heat, sound, electricity, etc. from passing through is called ____.
2. Building material that is made by mixing together cement, sand, small stones and water is called ____ .
3. The space in a building in which the stairs are built is called ____ .
4. A hollow metal device for heating rooms is called _____ .
5. A wide hard path or a private road that leads from the street to a house is called ___ .
6. That is easy to carry or to move is called _____ .

Exercise 4: Translate the following sentences into English.

1.Система обеспечения теплом зданий и сооружений называется теплоснабжением.

2. Теплоснабжение предназначено для обеспечения теплового комфорта людей, находящихся в здании.

3. Система теплоснабжения состоит из следующих функциональных частей: источника производства тепловой энергии; транспортирующих устройств тепловой энергии к помещениям; тепло потребляющих приборов, которые передают тепловую энергию потребителю (радиаторы отопления).

4. По месту выработки теплоты системы теплоснабжения делятся на централизованные и местные.

5. При централизованной системе теплоснабжения источник производства тепловой энергии работает на теплоснабжение группы зданий и связан транспортными устройствами с приборами потребления тепла.

6.При местной системе теплоснабжения потребитель и источник теплоснабжения находятся в одном помещении или в непосредственной близости.

7. Теплоносители в системе могут быть водяными или паровыми.

Exercise 5: Supplementary text for discussion.

Heat production

The principal sources of heat today are the fossil fuels, which give off heat when burned. These fuels may be solid, liquid, or gaseous. Among the more common solid fuels are coals, combustible shales, and peat. Petroleum is a natural liquid fuel, but it is seldom used directly to produce heat. Instead, it is refined to produce gasoline for automotive and piston aircraft engines, kerosene for jet engines and certain types of piston engines, and various types of diesel fuel and mazut, used chiefly in nonnuclear thermal power plants. The most important gaseous fuel is natural gas.

The most important characteristic of a fuel is the specific heat of combustion.

The concept of a standard fuel, having a heat of combustion of 29,308 kg is used for comparative calculations.

Coal is usually burned in furnaces. When relatively small quantities of fuel are required, laminar combustion fireboxes are used, where lumps of coal are burned on a grate through which air is blown. For burning larger quantities of coal (hundreds of tons per hour), chamber furnaces are used. Here, coal that has first been pulverized to particle sizes of 50-300 micrometers is mixed with air and fed into burners. Mazut furnaces and gas furnaces are similar to pulverized-coal furnaces but have different burner and nozzle designs.

In addition to organic and nuclear fuels, geothermal and solar energy have been found to have practical value in heat generation. Geothermal energy manifests itself in hot groundwater, which often comes to the surface in regions of volcanic activity, and in the general temperature increase with depth inside the earth.This temperature increase is expressed by the geothermal gradient, numerically equal to the temperature rise in degrees per 100 m of depth; for depths accessible to direct measurement, the gradient averages 0.03 C/m. while the heat from hot springs is

already being put use, the possibility of using heat from the earth's interior is as yet only being studied.

Various types of apparatus, such as furnaces, stoves, and combustion chambers, are used for fuel combustion. Fuel is burned in furnaces and stoves at a pressure close to atmospheric with air as the oxidizing agent. In combustion chambers, the pressure may be higher than atmospheric and oxygen air or air enriched with oxygen may serve as the oxidant.

Unit 5. Principles of Heat Power Engineering

Grammar: Present Simple Active, Passive

Vocabulary

transfer- передача
concern- касаться, относиться
volume- объем
finite – конечный
emit – выделять
radiate – излучать
exchange- обмен
joint – совместный
divide – делить
occur – происходить
proceed – продолжаться
determine - определять
equilibrium - равновесие
irreversibility- необратимость
blackbody –черное тело
flow - поток
laminar -пластинчатый
media - среда
narrow - узкий
emissivity- коэффициент излучения
free-flowing - сыпучий
steam boiler- паровой котел

Exercise 1: Read the text and translate.

Theoretical Principles of Heat Power Engineering

The processes of generating and using heat are based on theoretical principles in heat engineering, that is, on engineering thermodynamics and heat transfer.

Thermodynamics is concerned with the properties of macroscopic systems in a state of thermodynamic equilibrium and with the processes of transition between these states. An equilibrium state is completely described by a few physical parameters, for example, the state of a homogeneous liquid or gases determined by any two of three quantities of temperature, volume, and pressure. The energy equivalence of heat and work is established by the first law of thermodynamics. The second law of thermodynamics determines the irreversibility of macroscopic processes that proceed at a finite rate; it limits the maximum efficiency possible in converting heat into work.

Heat transfer is concerned with the processes of heat exchange between heat-transfer agents through a dividing space or wall and across an interface. In heat

engineering equipment, heat can be transferred by radiant heat exchange, convection, and heat conduction.

Radiant heat exchange is typical of furnaces and combustion chambers, as well as of certain stoves. The total energy radiated by anybody is proportional to the fourth power of the body's temperature.at a given temperature, a blackbody emits the most energy. Actual bodies are characterized by their emissivity's (total or spectral), which represent the portion of the energy of an ideal blackbody that a given body radiates (over the entire wavelength range or in a narrow band) at the same temperature.

Heat exchange by convection is carried out through the flow of matter in liquids, gases, and free-flowing media. The heating or cooling of liquids and gases in various heat-engineering apparatus occurs through convection, as in hot-blast stoves and the economizers in steam boilers. Here, the heat is transferred either to or from the wall by the turbulent agitation of the flow. The intensity of this process is given by the heat-transfer coefficient.

Heat exchange by conduction is typical of solid bodies and of the laminar flow of liquids and gases in conduct with a solid wall. In this case, heat is transferred by a microscopic process of energy exchange between the molecules or atoms of a body. In practice, the heat-transfer process is often caused by the joint effect of the above-mentioned types of heat exchange.

Exercise 2: Answer the questions.

1. What are the processes of generating and using heat based on?
2. Name the first law of thermodynamics.
3. What does the second law of thermodynamics determine?
4. How can heat be transferred in heat engineering equipment?
5. When does a blackbody emit the most energy?
6. What is heat exchange by convection carried out through?
7. What is given by the heat-transfer coefficient?
8. Heat is transferred by a microscopic process of energy exchange between the molecules or atoms of a body, isn't it?

Exercise 3: Choose the right word.

1. The processes of generating and using heat are based on … principles in heat engineering.

a) theoretical b) practical c) modern

2. Heat transfer concerns itself with processes of heat … between heat-transfer agents.

a) transfer b) exchange c) accumulation

3. Actual bodies are characterized by their … (total or spectral).

a) exchange b) energy c) emissivity's

4. The heat -transfer process is … caused by the joint effect of the above-mentioned types of heat exchange.

a) always b) seldom c) often

Exercise 4: Complete the sentences.

1. Thermodynamics is concerned with ….
2. … is typical of furnaces and combustion chambers ….
3. … increases with the thickness of the radiating layer.
4. the heating or cooling of liquids and gases are various ….
5. … transferred either to or from the wall ….

Exercises 5: Give Russian equivalents.

Equilibrium state, energy equivalents, heat-transfer agents, heat engineering equipment, heat conduction, radiant heat exchange, combustion chambers, certain stoves, entire wavelength range, hot-blast stoves, steam boilers, solid wall, turbulent agitation, heat-transfer coefficient, the laminar flow.

Exercise 6: Read and say if the statements are true, false or not stated in the text.

1. An equilibrium state is completely described by a few physical parameters.
2. The total energy radiated by any body proportional to the fifth power of the body's temperature.
3. The total emissivity of solid bodies usually lies in the range 0.5 - 0.8.
4. Heat exchange by conduction is typical of the laminar flow of liquids and gases in conduct with a solid wall.

Exercise 7: Make up a short summary of the text. Supplementary text for discussion

Electric Heating System

Electricity is a high-grade energy source that can be used for heating by sending current through resistance elements located, for instance, in conventional warm-air furnaces or hot-water boilers, or directly in baseboard units. In areas where economic factors justify its use, the electricity is supplied to homes under special all-electric rate schedules. Electricity has the advantages of convenience, cleanliness, low maintenance, and easy control, and it does not have the dangers associated with fuel burning.

Heating is required for both industrial and domestic purposes. In industries, heating is required for the melting of metals, molding of glass, enameling of cooper, baking of insulator and welding etc. In domestic purposes the heating is required for cooking, water heating, room heating in winter, pressing cloths and many more. All purposes of heating can be fulfilled by electricity. Electric heating has some advantages.

1. Electric heating is free from dirt hence minimum effort for cleaning is required.
2. Electric heating is free from flue gases hence no need of exhaust system for heat generation.

3. Temperature control can be done very easily.

4. An electric heating system is economical compared to other conventional heating systems available in the industry. Both the installation cost and running costs are quite low.

5. Automatic protection against any abnormality in the heating system can easily be provided in electrical heating.

6. The efficiency of the system is quite high compared to other equivalent heating system.

7. The electric heating system is noise free.

8. Starting of the system is quite faster than other heating systems.

Unit 6. What Is a Heating Plant?

Grammar: Participle I.

Vocabulary

Refer – относиться.
Outlying – отдаленный.
Handling – перемещение, траспортировка.
Feed - подача, питание.
Utilities – коммунальные предприятия.
Off-grid – зависящий от коммунальных служб.
Cooling tower – башенный охладитель.
Boiler – котельня.
Facility – объект, устройство.
Outage - простой, перебой.
Psig-pounds per square inch – фунт на квадратный дюйм.
Feed water - питательная вода.
Down comer – спускная труба.
Fossil fuel – ископаемое топливо.
Municipal waste – городские отходы.
Side stream – боковой поток.
Reboiler – кипятильник.
Boost – повышать.
Distribution system –система распределения

Exercise 1: Read and translate the text.

What Is a Heating Plant?

A heating plant refers to a steam or hot water heating system that serves a number of outlying buildings. It is specified by the type of equipment used. The equipment consists of boiler, pumps, valves, the piping of the steam water system, and the storage, handling and feed equipment of the fuel system. The key

components of a heating plant include operating conditions, type of boilers, and source of fuel.

Heating plants are common among older university campuses, rural or off-grid industrial sites and military complexes. Often these facilities are co-located with electric municipal or industrial utilities. Shared usage is common between processing plants that use high pressure steam and then forward the low pressure steam to a hospital or college to utilize the heat rather than discharge it to the environment via a cooling tower or cooling ponds. The space that houses a small boiler within the basement of single building is usually referred to as the boiler room, as opposed to a heating plant.

The capacity and operating pressure and temperature are key design questions determined by the anticipated heat load. To avoid complete outage, a heating plant usually has two or three boilers. Steam pressures are usually limited to less than 150 psig. A typical operating range is from 100 to 125 psig, but the most economical design will consider the higher cost of a higher pressure system versus the operating load required to heat the buildings.

A water-tube design is often used for boilers employed in heating plants. In this design, hot gases from the combustion of the fuel pass over steam-generating tubes in which water from the feed water drum is heated to boiling. The seam rises to a steam separation drum where condensed water flows by gravity through large tubes called down comers back to the feed water drum to preheat that input. Additional energy is added to the steam by heating it above its boiling point by drawing steam from the steam separation drum back through the hot gas chamber one more time.

The boiler can be fueled from variety of sources, including gas, or other fossil fuel. Many renewable resources are used as well, including geothermal heat, wood, municipal waste or agricultural biomass. The energy source is selected based on availability, cost, and heat load requirements. When a high-energy fuel source is present and the heat load is relatively low, cogeneration of electricity is possible from a side stream of steam passing through a turbine. A heating plant that is using a waste steam line from a high-pressure steam source may use a reboiler to boost the heating value of the incoming steam or may simply consist of distribution system.

Exercise 2: Answer the following questions.

1. What does a heating plant refer to?
2. What does the heating equipment consist of?
3. What do the key components of a heating plant include?
4. Are heating plants common nowadays?
5. What are key design questions determined by the anticipated heat load?
6. What conditions are suitable to avoid complete outage of a heating plant?
7. What design is often used for boilers employed in heating plants?
8. How do hot gases operate in this design?
9. What fuel sources can the boiler be fueled from?

10. How is the energy source selected?
11. Are there any conditions suitable for cogeneration of electricity?
12. What is reboiler used for?

Exercise 3: Match the English and Russian equivalents.

1.waterheating system	a. установка
2.heating plant	b.градирня
3.facility	с отопительная система
4.cooling tower	d. теплоцентраль
5.capacity	e.спускная труба
6. down comer	f. мощность

Exercise 4: Choose the right term from the list given below and complete the sentences.

Key components, shared usage, water-tube design, operating pressures, down comers, renewable resources, equipment, heating plant, feed water drum.

1. A … refers to a steam or hot water heating system that serves a number of outlying buildings.
2. The … consists of the boiler, pumps, valves, the piping of the steam water system, and the storage, handling and feed equipment of the fuel system.
3. The … of a heating plant include operating conditions, type of boilers, and source of fuel.
4. … is common between processing plants that use high pressure steam and then discharge it to the environment via a cooling tower or cooling ponds.
5. The capacity, … … and temperature are key design questions determined by the anticipated heat load.
6. A … is often used for boilers employed in heating plants.
7. The steam rises to a steam separation drum where condensed water flows by gravity through large tubes called … back to the … … to preheat that input.
8. Many … … are used as well, including geothermal heat, wood, municipal waste or agricultural biomass.

Exercise 4. Make up a short summary of the text. Supplementary text for discussion

Heat Engines

Energy sources have always played a very important role in the development of human society. Energy is generally defined as the potential to do work or produce heat. Sometimes it is like the “currency” for performing work. One of the most wonderful properties of the universe is that energy can be transformed from one type to another and transferred from one subject to another.

In general, it easy to produce thermal energy by doing work, for example, by any frictional process. But to get work from thermal energy is more difficult. It is closely associated with the concept of entropy. For example, electricity is particularly useful since it has very low entropy (is highly ordered) and can be converted into other forms of energy very efficiently.

Sometimes, mechanical energy is directly available, for example wind power and hydro power. But most of our energy comes from the burning the fossil fuels (coal, oil and gas) and from nuclear reactions. At present, fossil fuel is still the world's predominant energy source. But the burning of fossil fuels generates only thermal energy, therefore these energy sources are so called ''primary energy sources", that must be converted to secondary energy source, so called energy carriers (electrical energy etc.). To convert thermal energy into another form of energy a heat energy must be used.

In general, a heat energy is a device that converts chemical energy to heat or thermal energy and then to mechanical energy or to electrical energy.

Many heat engines operate in a cyclic manner, adding energy in the form of heat in one part of the cycle and using that energy to do useful work in another part of the cycle. For example, as a typical in all conventional thermal power plants the heat is used to generate steam which drives a steam turbine connected to a generator which produces electricity. Steam generators, steam turbines, condenses and feed water pumps constitute a heat engine, that is subject to the efficiency limitations imposed by the second law of thermodynamics. In modern nuclear power plants the overall thermodynamic efficiency is about one-third (33%), so 3000 MWt of thermal power from the fission reaction is needed to generate 1000 MWt of electrical power.

Unit 7. The Sun as a Source of Heat Energy

Grammar: Present Simple

Exercise 1: Read and translate the text

The Sun as a Source of Heat Energy

The transformation of a solar energy in electric possible through the use of solar cells, in which solar energy is induced into electric current without any additional devices. Although the efficiency of such devices is small, but they are beneficial to slow expendability due to absence of any moving parts. The main difficulties of the application of solar cells is related to their high cost and occupation of large areas for placement. The problem of some extent solved by replacing metal photo converter energy elastic synthetic, use of roof and walls of houses for the accommodation of batteries, carrying out the converters in outer space, etc. in those cases when you want to receive a small amount of energy, the use of solar cells currently economically expedient. In countries with a large

amount of solar radiation available projects complete electrification of certain branches of the economy, such as agriculture, at the expense of solar energy. Obtained in this way energy, especially for its high ecological compatibility, the value turns out to be more profitable than the energy produced by traditional methods. Solar station bribe is also the possibility to quickly input in operation and build their capacity in the process of operation of a simple merger of additional solar cell batteries. The second way of transformation of a solar energy in electric is connected with the transformation of water to steam, which drives the turbine generators. In this cases, for accumulating energy the most frequently used energy tower with a large number of lenses that concentrate the sun's rays, as well as special solar ponds. The essence of the latter is that they consist of two layers: the bottom with a high concentration of salts and upper presented transparent fresh water. The role of the material of the accumulating energy, performs a salt solution. The heated water is used for heating or vaporize the liquid, boiling at low temperatures. Solar energy, in some cases, promising also to get out of the water to hydrogen, which is called "the fuel of the future". The decomposition of the water and release of hydrogen is in the process of bandwidth between the electrodes of the electric current produced by Heli plants. Disadvantages of such facilities as related to low efficiency (the energy contained in hydrogen, only 20% higher than that spent on electrolysis of water) and high Flammability of hydrogen, as well as its diffusion through the storage capacity.

Exercise 2: Give Russian equivalents to the given word combination

Solar energy; coil; oil; a liquid; soil; solar houses; to melt temperature; a large amount of; solar heating; fuel; a source; solar cookers; an insulated box.

Exercise 3: Complete the following sentences using the words from the text.

….. … is used to provide heat and operate machines. It is an … source of energy in the sky. The most primitive device for catching the … of the sun is the gardener's …. A more … device is the …. Good mediums to store energy are water, Glauber's salt and … .

Exercise 4: Grammar exercises. Use the correct forms of the verbs:

1. All the energy (to come) from the sun.
2. Heat pumps (to cool) the air in the summer.
3. Glauber's salt (to melt) at a temperature of 90 F.
4. The engineers (to be) aware of the great possibilities of solar heating.
5. India (to have) a very limited supply of fuel.
6. An important device (to be) the solar 'still'.
7. The heat of the sun (to evaporate) the water.

Exercise 5: Make up all possible questions to these sentences

1. The vapor condenses in droplets on the glass roof.
2. The solar battery can use thermocouples.

3. Water is a good medium.

Exercise 6: Translate the following sentences.

1. The gas is then compressed by means of a pump and goes into a condenser coil, where it changes back to a liquid, thus setting its heat free; this can be made to heat the house or to provide hot water.

2. Another interesting medium is gravel, incorporated in the walls of the house, which it keeps warm on sunless days; by means of a small ventilator, hot air from a heat collector on the roof is circulated through the gravel, which releases its accumulated heat at an even rate.

Exercise 7. Give English equivalents:

Обеспечивать, снабжать горячей водой; вещество; сохранить тепло; аккумилированное тепло; циркулировать; ограниченный запас; удобрять почву; избыток испаряет воду; солнечная батарея; полупроводник; кремний; ток низкого напряжения; солнечная лампа; термоэлементы.

Exercise 5. Using the words given below, complete the following sentences:

Efficient; a solar lamp; inexhaustible; evaporates; low-voltage current; a heat pump; cool; solar battery

1. The vast and almost … source of energy is in the sky.
2. A more … device is … .
3. Many heat pumps … the air in summer.
4. The sun … the water.
5. The most efficient way of generating electricity from sunlight, however, seems to be the … .
6. Solar batteries may provide the … needed in a house.
7. French scientists designed … .

Exercise 6. Give complete answers to these questions:

1. What is the solar energy?
2. Where may the solar energy be used?
3. What are good mediums to store the heat?
4. What are other natural resources except the sun that may produce some energy if they are burnt?
5. How does the solar battery work?
6. What elements does a solar lamp consist of?

Exercise 7. Make up a short summary of the text.

Unit 8. Atomic Energy

Grammar: Participle II
Exercise1: Read and translate the text

Atomic Energy

A man trying to see a single atom is like a man trying to see a single drop of water in the sea while he is flying high above it. He will see the sea made up of a great many drops of water but he certainly will not be able to see a single drop. By the way, there are so many atoms in the drop of water that if one could count one atom a second, day and night, it would take one hundred milliard years. But that is impossible.

Man has, however, learned the secret of the atom. He has learned to split atoms in order to get great quantities of energy. At present, coal is one of the most important fuel and a basic source of energy. It is quite possible that some day coal and other fuel may be replaced by atomic energy. Atomic energy replacing the present sources of energy, the latter will find various new applications.

The nuclear reactor is one of the most reliable 'furnaces' producing atomic energy. Being used to produce energy, the reactor produces it in the form of heat. In other words, heat is developed while atoms splitting in the reactor. Gas, water, melted metals, and some other liquids circulating through the reactor carry that heat away. The heat may be carried to pipes of the steam generator containing water. The resulting steam drives a turbine, the turbine in its turn driving an electric generator. A nuclear power station is like any other power station but the familiar coal-burning furnace is replaced by a nuclear one that is the reactor supplies energy to the turbines. (A ton of uranium (nuclear fuel) can give as much energy as 2.5 to 3 million tons of coal).

The first industrial nuclear power-station in the world was constructed in Obninsk not far from Moscow in 1954. It is of high capacity and has already been working for many years. One may mention here that the station in question put into operation two years earlier than the British one and three and half years earlier than the American nuclear power-stations.

Russian scientists and engineers achieved a nuclear superheating of steam directly in the reactor itself before steam is carried into the turbine. It is certainly an important contribution to nuclear engineering achieved for the first time in the world.

There is another important achievement: the first nuclear installation where thermal energy generated in the reactor is transformed directly into electrical energy.

The importance of atomic energy will grow still more when fast neutron reactors are used on a large scale. These reactors can produce much more secondary nuclear fuel than the fuel they consume.

Exercise 2: Answer the following questions:

1. Is it possible to see an atom with the man's eye?
2. What secret of the atom has Man learned?
3. What was achieved by scientists?
4. What is a nuclear ice-breaker?

Exercise 3: Give Russian equivalents to the following word-combinations:

To split atoms; to get great quantities of energy; a basic source of energy; various applications; a nuclear reactor; to produce in the form of heat; to carry heat away; liquids circulating through a reactor; pipes of a steam generator; resulting steam; coal-burning furnace; a nuclear superheating; nuclear installation; fast neutron reactors; on a large scale.

Exercise 4: Give corresponding passive constructions. Use the model.

Model: Man learned the secret of the atom.

The secret of atom was learned.

1. Man split atoms.
2. Workers constructed the first industrial nuclear power-station in 1954.
3. People used fast neutron reactors.
4. Reactors produced much energy.
5. Reactor carried away the heat.
6. People put into operation a lot of power-stations.

Exercise 5: Translate the following word-combinations. Pay attention to the usage of Participle II.

Coal and other fuel replaced by atomic energy; thermal energy generated in the reactor; the steam produced by three reactors; the heat carried to pipes; the nuclear power-station named after the academician.

Exercise 6: Make up and write down all types of questions to the following sentences.

1. Man learned the secret of atom.
2. The resulting steam drives a turbine.
3. The first nuclear power-station was constructed in Obninsk.

Exercise 7: Insert the suitable words from the active vocabulary.

To split; ice-breakers; in the form of heat; put into operation; quantities; nuclear; industrial; furnaces

1. Man has learned … atoms in order to get great … energy.
2. The … reactor is one of the most reliable … producing atomic energy.
3. Being used to produce energy, the reactor produces it … .
4. The first … nuclear power-station was constructed in Obninsk.
5. A number of nuclear power-station have been … since 1954.

6. Speaking of the peaceful use atomic energy it is also necessary to mention nuclear … .

Exercise 8: Find five key sentences in the text and use them to review the text.

Unit 9. Thermal Power Station

Grammar: Comparative and Superlative Degrees.

Vocabulary

Thermal power-station – ТЭС.
Coal handling - угольная эстакада.
Storage – хранилище.
Boiler house – котельная.
Turbine house – ГЭС.
Switchgear - аппаратура распределительных устройств.
Coal-handling plant - завод топливоподачи.
Ash-disposal plant - золоудалительный завод.
Flue gases - дымовые газы.

Exercise1: Read and translate the text

Thermal Power Station

A modern thermal power-station is known to consists of four principal components, namely, coal handling and storage, boiler house, turbine house, switchgear.

Besides the principal components mentioned above there are many additional parts of the plant. The most important of them is the turbogenerator in which the current is actually generated.

A steam turbine requires boilers to provide steam. Boilers need a coal-handling plant on the one hand and ash-disposal plant on the other. Large fans are quite necessary to provide air for the furnaces. Water for the boilers requires to feed pumps. Steam must be condensed after it has passed through the turbines, and this requires large quantities of cooling water. The flue gases carry dust which must be removed by cleaning the gases before they go into the open air.

A modern thermal power station is equipped with one or more turbine generator units which convert heat energy into electric energy. The steam drives the turbine which, in its turn, turns the rotor or revolving part of the generator is generated in boilers heated by furnaces in which one of three fuels may be used-coal, oil and natural gas. Coal continues are the most important and the most economical of these fuels.

It is necessary to point out that the power machine building industry has started to manufacture even greater capacity installations for thermal power-stations.

Thermal power station are considered to be the basis of Russia power industry. More than 80% of the country's total power output comes from the above stations.

It is necessary to say that separate power-stations in our country are integrated into power systems. Integration of power systems is a higher stage in scientific and technical development of power engineering. The integrated power system in the central part of Russia is one of the largest in the world.

Exercise 2: Give Russian equivalents to the following words and word-combination.

To consist of four principal components; turbogenerator; turbine requires boilers; furnaces; fans; pumps; be condensed after; cooling water; dust; equipped with; convert heat energy inti electric energy.

Exercise 3: Fill the blanks in the sentences below with the words from Exercises 1 and 11.

1. The heated or vaporized fluid exists the … for use in various processes or heating applications.
2. The oil shale burnt at Narva produces roughly 46% ash. So the stations produce about 4.5 million tons of ash per year; the … system involves washing it away with water.
3. …. … is commonly used for cooling internal combustion engines in automobiles and large electrical generators.
4. … produce air flows with high volume and low pressure, as opposed to compressors which produce high pressures at a comparatively low volume.
5. … are devices used to move fluids.
6. … in homes, offices, and other human environments contains small amounts of human and animal hairs, textile fibers, paper fibbers, minerals from outdoor soil, and many other materials which may be found in the local environment.
7. The house … painting.
8. A cricket team … … eleven players.
9. The rooms are … … video cameras.

Exercise 4: Make up all types of questions to the sentences.

1. Thermal power-stations are considered to be the basis of Russia power industry.
2. Large fans are quite necessary to provide air for the furnaces.

Exercise 5: Give English equivalents to the following:

Блоки генераторов; ротор; вращающаяся деталь; мощные установки; выходная мощность; объединение в одно целое энергетических систем.

Exercise 6: Using the words given below, complete the following sentences.

Utilize, generators, distribution system, network, transmission system, components, industry

An electric power system is a … of electrical … used to supply, transmit and … electric power. The quintessential example of an electric power system is the network that supplies a region's homes and industry with power- for sizable regions, this power system is known as the grid and can be broadly divided into the … that supply the power, the … … that carries the power from the generating centers to the load centers and the … … that feeds the power to nearby homes and industries. Smaller power systems are also found in …, hospitals, commercial buildings and homes.

Exercise 7. Answer the following questions:

1. What are the four principal components a modern thermal power- station consists of?
2. What is the most important additional component in a thermal power-station?
3. In brief, how does a thermal power-station work?
4. What is the most important and economical fuel for a thermal power-station?

Exercise 8: Give a short summary of the text. Supplementary text for discussion.

Hydroelectric Power-Station

Water power was used to drive machinery long before Polzunov and Games Watt harnessed steam to meet man's needs for useful power.

Modern hydroelectric power-station use water power to turn the machines which generate electricity. The water power may be obtained from small dams in rivers or from enormous sources of water power like those to be found in Russia. However, most of our electricity, that is about 86 per cent, still comes from steam power-station.

In some other countries, such as Norway, Sweden, and Switzerland, more electric energy is produced from water power than from steam. They have been developing large hydroelectric power-stations for the past forty years, or so, because they lack a sufficient fuel supply. The tendency, nowadays, even for countries that have large coal resources, is to utilize their water power in order to conserve their resources of coal. As a matter of fact, almost one half of the total electric supply of the world comes from water power.

The locality of a hydroelectric power plant depends on natural conditions. The hydroelectric power plant may be located either at the dam or at a considerable distance below. That depends on the desirability of using the head supply at the dam itself or the desirability of getting a greater head. In the latter case, water is conducted through pipes or open channels to a point farther downstream where the natural conditions make a greater head possible.

The design of machines for using water power greatly depends on the nature of the available water supply. In some cases great quantities of water can be taken from a large river with only a few feet head. In other cases, instead of a few feet, a head of several thousands of feet may be had. In general, power may be developed from water by action of its pressure, of its velocity, or by a combination of both.

A hydraulic turbine and a generator are the main equipment in a hydroelectric power-station. Hydraulic turbines are the key machines converting the energy of flowing water into mechanical energy. Such turbines have the following principal parts: a runner composed of radial blades mounted on a rotating shaft and a steel casing which houses the runner. There are two types of water turbines, namely, the reaction turbine and the impulse turbine. The reaction turbine is one for low heads and a small flow. Modified forms of the above turbine are used for medium heads up to 500-600 ft, the shaft being horizontal for the larger heads. High heads, above 500 ft, employ the impulse type turbine. It is the reaction turbine that is most used in Russia.

Speaking of hydraulic turbines, it is interesting to point out that in recent years there has been a great increase in size, capacity, and output of Russian turbines.

Hydropower engineering is developing mainly by constructing high capacity stations integrated into river systems known as cascades.

Exercise 9: Answer the following questions:

1. In what countries is a lot of electric energy produced from water?
2. What does the locality of electric power plants depend on?
3. What are the two types of water turbines? Name them, please.
4. What are the principal pats of a hydraulic turbines?

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