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**ИНОСТРАННЫЙ ЯЗЫК
ТЕХНОЛОГИЧЕСКИЕ МАШИНЫ И ОБОРУДОВАНИЕ
(ОБОРУДОВАНИЕ НЕФТЕГАЗОПЕРЕРАБОТКИ)**

*Методические указания к практическим занятиям
для студентов специальности 15.03.02*

**FOREIGN LANGUAGE
TECHNOLOGICAL MACHINES AND EQUIPMENT
(OIL AND GAS PROCESSING EQUIPMENT)**

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ПРЕДИСЛОВИЕ

Данные методические указания предназначены для учебно-методического сопровождения курса английского языка для студентов неязыковых вузов, обучающихся по направлению подготовки 15.03.02 «Технологические машины и оборудование», профиль подготовки «Оборудование нефтегазопереработки». Методические указания составлены в соответствии с учебной программой по дисциплине «Иностранный язык» для формирования иноязычной профессиональной компетенции будущих специалистов. В методические указания включены аутентичные тексты, в которых освещаются основные виды оборудования в нефтегазопереработке.

Изучение материала преследует цель развития навыков и умений просмотрового и изучающего чтения текстов по направлению подготовки, а также их перевода на русский язык с последующим использованием полученной информации для речевой практики; овладение студентами иноязычной коммуникативно-речевой компетенцией, позволяющей будущему специалисту осуществлять профессиональную коммуникацию; формирование активного словарного запаса, который включает наиболее употребительные английский термины и выражения по теме «Technological machines and equipment (Oil and gas processing equipment)».

UNIT 1. FRACTIONATING COLUMN

I. Read and translate the following text.

A fractionating column or fractional column is an essential item used in the distillation of liquid mixtures to separate the mixture into its component parts, or fractions, based on the differences in volatilities. Fractionating columns are used in small scale laboratory distillations as well as large scale industrial distillations.

Fractional distillation is one of the unit operations of chemical engineering. Fractionating columns are widely used in the chemical process industries where large quantities of liquids have to be distilled. Such industries are the petroleum processing, petrochemical production, natural gas processing, coal tar processing, brewing, liquefied air separation, and hydrocarbon solvents production and similar industries but it finds its widest application in petroleum refineries. In such refineries, the crude oil feedstock is a complex, multi-component mixture that must be separated, and yields of pure chemical compounds are not expected, only groups of compounds within a relatively small range of boiling points, also called fractions. That is the origin of the name fractional distillation or fractionation.

Distillation is one of the most common and energy-intensive separation processes. Effectiveness of separation is dependent upon the height and diameter of the column, the ratio of the column's height to diameter, and the material that comprises the distillation column itself. In a typical chemical plant, it accounts for about 40% of the total energy consumption. Industrial distillation is typically performed in large, vertical cylindrical columns known as «distillation towers» or «distillation columns» with diameters ranging from about 65 centimeters to 6 meters and heights ranging from about 6 meters to 60 meters or more.

Industrial distillation towers are usually operated at a continuous steady state. Unless disturbed by changes in feed, heat, ambient temperature, or condensing, the amount of feed being added normally equals the amount of product being removed.

The amount of heat entering the column from the reboiler and with the feed must equal the amount heat removed by the overhead condenser and with the products. The heat entering a distillation column is a

crucial operating parameter, addition of excess or insufficient heat to the column can lead to foaming, weeping, entrainment, or flooding.

Industrial fractionating columns use external reflux to achieve better separation of products. Reflux refers to the portion of the condensed overhead liquid product that returns to the upper part of the fractionating column.

Inside the column, the down-flowing reflux liquid provides cooling and condensation of up-flowing vapors thereby increasing the efficacy of the distillation tower. The more reflux and/or more trays provided, the better is the tower's separation of lower boiling materials from higher boiling materials [2].

II. Study the following words and expressions:

Fractionating column – ректификационная колонна, volatility – летучесть, chemical engineering – химическое производство, технология, petroleum processing – нефтепереработка, petroleum production – нефтехимическое производство, natural gas processing – газопереработка, coal tar processing – переработка каменноугольной смолы, petroleum refinery – нефтеперерабатывающий завод, ambient temperature – температура окружающей среды, наружная температура, reboiler – испаритель-рекуператор, нагреватель на дне ректификационной колонны, газодегридационный котел, foaming – вспенивание, пенная флотация, weeping – просачивание, entrainment – вынос, увлечение (жидкостью, газом), унос, flooding – заполнение, заводнение, обводнение, external reflux – дополнительное орошение, холодное орошение, наружное орошение, efficacy – эффективность действия.

III. Complete the table and make 5 sentences with any of the words from the table.

verb	noun	adjective/participle
separate		
	fraction	
	distillation	

		produced
operation		
	condensation	

IV. Answer the following questions:

1. What is a fractionating column?
2. Where are fractionating columns used?
3. What are the industries where fractionating columns are applied?
4. What is the most common and energy-intensive separation process?
5. What are characteristics of industrial distillation columns?
6. What is external reflux used for?
7. What does the efficacy of the distillation tower depend on?

V. Insert the missing words and expressions:

Foaming, distillation, ambient temperature, petroleum refineries, chemical engineering, flooding

1. Fractional distillation is one of the unit operations of _____.
2. _____ is one of the most common and energy-intensive separation processes
3. The heat entering a distillation column is a crucial operating parameter, addition of excess or insufficient heat to the column can lead to _____, weeping, entrainment, or _____
4. Unless disturbed by changes in feed, heat, _____, or condensing, the amount of feed being added normally equals the amount of product being removed.
5. In _____, the crude oil feedstock is a complex, multi-component mixture that must be separated,

VI. Grammar task. Open the brackets.

1. Agatha Christie... (**write**) her novel, The Murder on the Orient Express, in 1933.

2. We invited Charles and Margaret to the wedding party, but I'm not sure they ... **(come)**.
3. Charles ... **(come)** to see the psychiatrist every week after the accident.
4. Richard ... **(play)** the saxophone at 7 o'clock yesterday.
5. Emily's salary is ... *(a degree of comparison of high)* than her sister's.
6. Vivienne took as ... *(many/ much/ a little/ a lot)* books as she could carry herself.
7. ... Nick ... **(play)** cricket next Saturday?
8. A German racing car ... just ... **(break)** the world speed record.
9. Just look at that! They ... **(play)** again!
10. My Granny ... *(a modal verb of ability)* sing very well when she was young.
11. Saint-Petersburg is one of... *(a degree of comparison of beautiful)* city in Russia.
12. Tesla cars ... **(drive)** by electricity.
13. If I ... **(see)** Veronicka, I will tell her about the exhibition.
14. Please, don't forget ... **(feed)** my cat while I'm away.
15. The city would look more beautiful if people ... **(not throw)** rubbish on the streets.
16. It's great to see the children ... **(play)** together.
17. You ... *(a modal verb of advice / not)* drink so much coffee. It's not healthy.
18. The criminal ... just ... **(stop)** by the police officers.
19. To our surprise, we got ... *(very few/ a little/ much/ a lot)* letters last week.
20. I ... **(wait)** for you since 09.00 this morning.

UNIT 2. TYPES OF HEAT-EXCHANGERS

I. Read and translate the following text. Make up the plan of the text.

The conventional gas-to-gas heat exchanger is vertical shell and tube heat exchanger with single segmental baffles. These exchangers are typically over designed for the intended duty because of the following:

single segmental baffles create a dead zone in the shell side flow path; nozzle orientations are restricted due to the single segmental baffles; gas entering the shell side impinges only one side of the tube bundle; high thermal stresses are induced by the cross flow arrangement; large tube bundles makes it more difficult to obtain uniform flow on the shell and tube side; high shell side pressure drops required to obtain acceptable heat transfer coefficients; non-uniform and non-symmetrical temperature profiles occur on the shell side.

In a heat exchanger with single segmental baffles, gas will flow across the tube bundle first and then parallel to the tubes before encountering the next baffle which forces the gas back across the tubes. The different flow patterns on the shell side makes it difficult to design and predict heat transfer coefficients.

An improvement on the single segmental baffle is the double segmental baffle. The gas is introduced to the two bundles at two points 180° apart. The gas flows across the tube towards the centre of the tube bundle by two baffles. At the centre of the tube bundle the space between the baffles allows the gas to flow along tubes into the next baffle section. A single baffle located in the centre of the tube bundle forces the gas back out across the tube bundle towards the shell. This pattern of flow is repeated until the desired thermal characteristics are achieved.

The principal behind the radial flow heat exchangers is the use of disc and donut baffles. The donut baffle forces the gas to flow from the outside to the inside and through the hole in the middle of the baffle while the disc baffle does the opposite. Placing the tubes within the overlapping area of the disc and donut baffles means the all the gas flow will be essentially across the tubes only. The disc and donut baffles are symmetrical around their centre so it does not matter where the gas enters or exits the shell side of the heat exchanger.

Plate type heat exchangers are relatively new to the industry. The principal of plate heat exchangers is similar to the plate heat exchangers used in acid cooling service. The cooling and heating streams flow on either side of a thin plate through which heat transfer occurs.

The heat exchanger is modular in construction allowing it to be fully shop fabricated and expanded easily. Different materials of construction can be used for the modules taking advantage of better corrosion resistance or high temperature strength.

Hot exchangers generally cool the hot gases leaving the first catalyst pass before entering the second catalyst pass. The cooling medium is generally the partially heated gas entering the plant going to the first catalyst pass. Maximum temperatures can reach as high as 625°C depending on gas strength.

Cold exchangers are generally the first heating stage for the incoming gas and the final cooling stage for the gas entering the final absorbing tower. Old exchangers are generally constructed of carbon steel since the operating temperatures are not as in hot exchangers. The problem that cold exchangers must contend with that hot exchanger do not, is the possibility of gas condensation. From a corrosion point of view, carbon steel is not the best choice of materials [2].

Vocabulary

absorbing tower –	impinge – отражаться, ударять,
абсорбционная колонна;	сталкиваться;
baffle – перегородка	incoming gas – поступающий
carbon steel – черная сталь;	газ;
corrosion resistance – коррозий-	modular – блочный, модуль-
ная стойкость;	ный;
heat-exchanger – теплообмен-	overlapping area – перекры-
ник;	вающая зона;
heat transfer coefficient – ко-	shell side – межтрубное про-
эффициент теплопередачи;	странство;
(теплообмена, теплоотдачи)	tube bundle – трубный пучок в
high temperature strength - тер-	подогревателе;
мическая стойкость;	tube side – трубное простран-
	ство

II. Answer the questions.

1. What are the types of heat-exchangers mentioned in the text?
2. Can you describe the difference between heat-exchangers with single or double segmental baffles?
3. How do the radial flow heat-exchangers work?
4. What is the difference between hot exchangers and cold exchangers?

III. Insert the missing words and expressions:

Modular, heat transfer coefficients, heated gas, segmental baffles,
hot gases, a thin plate, baffle section

1. The conventional gas-to-gas heat exchanger is vertical shell and tube heat exchanger with single _____.
2. The cooling medium is generally the partially _____ entering the plant going to the first catalyst pass.
3. The different flow patterns on the shell side makes it difficult to design and predict _____.
4. The heat exchanger is _____ in construction allowing it to be fully shop fabricated and expanded easily.
5. The cooling and heating streams flow on either side of _____ through which heat transfer occurs.
6. Hot exchangers generally cool the _____ leaving the first catalyst pass before entering the second catalyst pass.
7. At the centre of the tube bundle the space between the baffles allows the gas to flow along tubes into the next _____.

IV. Find further information about types of heat-exchangers, manufacturers of heat-exchangers.

V. Grammar task. Open the brackets.

1. I can't give you a decision yet. I need _____ (*very few/ a little/ much/ a lot*) time to think.
2. My father drives _____ (*a degree of comparison of fast*) than me.
3. You _____ (*a modal verb of advice*) take warm clothes with you to Dublin. It might be cold at night.
4. I want to lose weight, so this week I _____ (**not eat**) lunch.
5. Suddenly everybody stopped _____ (**talk**). There was silence.
6. That's _____ (*a degree of comparison of funny*) joke I've ever heard.

7. It's a big factory. Five thousand people _____ (**employ**) there.
8. If your sister were here, she _____ (**know**) what to do.
9. Susan _____ (**watch**) television when the phone rang.
10. 'Where's your key?' 'I don't know. I _____ (**lose**) it.'
11. My cousin _____ (*a modal verb of ability*) play the violin when she was five.
12. I _____ (**work**) for a charity for eight years.
13. Don't worry about the exam. I'm sure you _____ (**pass**) it.
14. I was very thirsty. I _____ (**drink**) the water very quickly.
15. Alison won't get into university unless she _____ (**get**) good grades.
16. The room looks nice. It _____ (**clean**).
17. Do you have _____ (*many/ much/ a little/a lot*) close friends?
18. It was late, so we decided _____ (**take**) a taxi home.
19. The earth _____ (**go**) round the sun.
20. We _____ (**have**) a party next Saturday. Would you like to come?

UNIT 3. PUMP

I. Read each word or word combination. Mind the stress. Find the meaning.

Sucker rod pumping, the most widespread from, bottom-hole pumps, pump barrel, tubing string, tubing pump, effective, certain, special, reciprocating motion, relatively, high rotating speed, rotation, linear motion, furnish, operating mechanism, maintaining alignment, drainage, curvature.

II. Read and translate the text. Make a plan of the text.

Sucker rod pumping is the most widespread form of artificial lift used since the earliest days of the oil industry. The pumps are functionally the same as water-well pumps used as long as 1,500 years ago in China, Egypt, and Rome.

There are two basic types of bottom-hole pumps used for sucker rod pumping - Tubing pumps and Insert pumps.

The tubing pump is so named because the pump barrel is run on the tubing string. The plunger is run into the well on the sucker rods. The inside diameter of a tubing pump barrel is just slightly smaller than that of the tubing on which it is run, giving the highest pumping rate possible for a given installation. Replacing the barrel of a tubing pump requires pulling the tubing.

The most common tubing and insert pump designs are controlled under API (American Petroleum Institute) specifications. Certain non-API pump designs - the casing pump and the multistage pump - have been shown to be effective under certain special well conditions.

The sucker rod pumping unit furnishes power in the form of reciprocating motion to the top of the sucker rod string. The length of the stroke may vary from less than one foot to as much as eighty feet.

The relatively high rotating speed of the motor is first reduced by the belt drive and then by the gear reducer to rotation of the crank at the desired strokes/minute rate. Rotation of the crank is converted through the crank arm, crank pin bearing, Pitman, equalizer, and equalizer bearing into reciprocating motion of the walking beam. Walking beam motion is then converted to linear motion of the polished rod by the horse-head and hanger.

Although a number of different types of pumping units are used to furnish reciprocating vertical motion to the top of the sucker rods in a sucker rod pumping system, over 99% are beam pumping units.

The pumping unit structure includes the base and the Samson post. In addition, the walking beam, equalizer, and Pitman, which are parts of the operating mechanism, must be considered as structural members.

The base is a rigid structure supporting the loads of the prime mover, speed reducer, and Samson post and transmitting these loads uniformly to the unit foundation. It must support these components and the operating mechanism while maintaining alignment for proper operation of the unit.

Actual foundation area and depth are dependent upon local soil conditions. The foundation must distribute the unit loads to the soil so that there is no rocking of the unit during operation. Drainage around the

unit foundation should prevent rainfall or other water from soaking in around the foundation to weaken the soil support.

The Samson post is usually fabricated from three or four legs of rolled steel shapes. It must support the walking beam, horse-head, equalizer, pitman, and more than twice the peak polished rod load. On top is the center bearing, or saddle bearing, which supports the walking beam. The radius of curvature of the horse-head by design is the centerline of the center bearing.

Some conventional units have provisions for moving the walking beam relative to the saddle bearing. This provision should be used only for adjusting alignment. If used for changing stroke length, the center of curvature of the horse-head will not be the centerline of the center bearing, resulting in nonlinear motion of the polished rod. Decreased polished rod life and decreased stuffing box packing life will result [3].

III. Match the left and the right.

1. Samson post	a) Стойка балансира
2. Sucker rod pumping	b) АНИ (Американский Нефтяной Институт)
3. API (American Petroleum Institute)	c) плечо кривошипа
4. Insert pumps	d) шатун балансира станка-качалки
5. Tubing pumps	e) штанговый глубинный насос
6. API specifications	f) погружной бесштанговый насос
7. Pump barrel	g) трубный насос
8. Crank arm	h) вставной скважинный насос
9. Pitman	i) технические условия АНИ
10. Bottom-hole pumps	j) корпус насоса

IV. Find in the text English equivalents of the following Russian words and expressions.

Стабилизатор, частота вращения, возвратно-поступательное движение, нефтедобывающая отрасль промышленности, радиус кривизны, сальник для каната, колонна напорно-компрессорных труб, трубная подвеска, штанговый глубинный насос, колонна насосных штанг (труб), первичный привод, штанговый насос, балансир насосной установки, штанговый насос обсадной лифтовой колонны, многоступенчатый насос, линейное движение, редуктор скорости

V. Find 9 words from the unit:

P	I	C	U	R	V	A	T	U	R	E	V	E	S	D	I
U	W	H	P	O	P	A	P	I	O	T	I	N	G	R	N
M	E	Q	U	A	L	I	Z	E	R	K	J	E	A	I	D
P	U	D	R	A	I	N	A	G	E	O	S	H	R	L	U
I	A	P	R	E	S	P	L	I	T	T	I	N	G	L	S
N	R	L	I	N	E	A	R	S	H	T	I	N	I	N	T
G	R	E	P	I	T	M	A	N	I	O	N	A	B	E	R
G	Y	A	L	I	G	N	M	E	N	T	S	N	I	O	Y

VI. Grammar task. Open the brackets.

1. Sorry, she can't talk to you. She (**have**) _____ a bath.
2. They (**be**) _____ married since 2000.
3. While we (**wait**) _____ for the train, it started to snow.
4. When (**start**) _____ this show?

5. A new airport (**build**) _____ in this city now.
6. Susan (**drink**) _____ coffee every day.
7. This is (*a degree of comparison of good*) _____ book I've ever read. It is really a page-turner.
8. Where have you been? I (**wait**) _____ for you for 40 minutes.
9. We (**go**) _____ to the cinema yesterday.
10. We will go for a walk if it (**not rain**) _____.
11. Richard has (*many/much/a little/few*) _____ friends. This makes him lonely.
12. My bag is (*a degree of comparison of heavy*) _____ than yours. Can you help me to carry it?
13. You (*a modal verb of obligation/not*) _____ touch this switch! It's forbidden by the rules.
14. I (**leave**) _____ at 6 a.m. tomorrow. I bought a return ticket to Moscow two weeks ago.
15. This landscape (**paint**) _____ by Ivan Shishkin.
16. It's so wonderful (**see**) _____ you again.
17. How (*much/many/a few/a little*) _____ apples do we need to prepare this pie?
18. If I (**know**) _____ her phone number, I would call her.
19. I usually avoid (**drive**) _____ in the rush hour.
20. Emma (*a modal verb of ability*) _____ sing very well when she was four.

UNIT 4. CENTRIFUGAL COMPRESSOR

I. Read and translate the text.

The basic components of a centrifugal compressor are impellers that are mounted on a horizontal shaft. They are the primary rotating elements that impart velocity to the gas. Impellers are also called wheels. Diffusers are stationary elements mounted in the compressor casing.

There is one diffuser downstream of each impeller. The diffuser converts velocity to pressure. Each diffuser is contained in a removable section of the casing called a diaphragm. Each diaphragm also has a passage that directs the gas to the suction of the next impeller. Each impeller and diffuser assembly is a stage of compression. The shaft is supported at both ends by journal bearings. These are normally tilt-pad type bearings. Another bearing mounted on the shaft is a thrust bearing. The thrust bearing absorbs the axial or horizontal force generated by unequal pressures on the impellers. A balance piston mounted on the shaft neutralizes as much thrust as possible. This neutralization is accomplished by connecting a high-pressure zone to one side of the piston and a low-pressure zone to the other side of the piston. The residual thrust is absorbed by the thrust bearing on the end of the shaft. This value changes as a function of compressor differential pressure.

Case seals are located at each place where a shaft enters the casing. Normally there are two seals for each casing. These seals usually contain pressurized oil to prevent the leakage of any gas from the inside of the compressor to the atmosphere. However, gas seals can also be used. Internally, labyrinth seals minimize recirculation of gas from high-pressure zones to lower pressure zones.

The casing of a centrifugal compressor is divided, or split, into halves that are held together by bolts. This division permits access to the internal parts without disconnecting the suction or discharge piping if the nozzles are mounted on the lower half of the casing. The casing may be split horizontally into an upper and lower half or it may be split vertically so that one end of the compressor is removable. The vertical split is called a barrel compressor [4].

Vocabulary

barrel compressor – компрессор типа «Баррель» (центробежный компрессор с вертикальным разъемом корпуса);
bolt – соединять, крепить болтами;

compressor casing – кожух (корпус) компрессора;
diffuser – диффузор;
horizontal shaft – горизонтальный ствол;
impart – придавать, передавать, сообщать движение;

impeller – лопастное рабочее колесо (компрессора);
 internal – внутренний;
 journal bearing – подшипник скольжения, коренной (фрикционный) подшипник;
 leakage – утечка (нефти);
 stationary – неподвижный, стационарный;

suction – подсос (воздуха), вход компрессора, прием насоса;
 tilt-pad – наклонный вкладыш;
 thrust bearing – опорная часть, опорный подшипник;
 velocity – скорость

II. Match the left and the right.

1.basic	a) elements
2.compressor	b) compressor
3.removable	c) section
4.rotating	d) bearings
5.journal	e) piston
6.high-pressure	f) components
7.thrust	g) parts
8.vertical	h) split
9.internal	i) zone
10.balance	j) bearing
11.stationary	k) elements
12.centrifugal	l) casing

III. Complete the sentences with the missing words.

leakage, diffusers, velocity, impellers (2), recirculation, centrifugal compressor

1. Impellers are the primary rotating elements that impart _____ to the gas.
2. _____ are stationary elements mounted in the compressor casing.
3. Case seals usually contain pressurized oil to prevent the _____ of any gas from the inside of the compressor to the atmosphere.

4. The casing of a _____ is divided, or split, into halves that are held together by bolts.
5. The basic components of a centrifugal compressor are _____ that are mounted on a horizontal shaft.
6. The thrust bearing absorbs the axial or horizontal force generated by unequal pressures on the _____.
7. Internally, labyrinth seals minimize _____ of gas from high-pressure zones to lower pressure zones.

IV. Check your knowledge.

1. What is a centrifugal compressor?
2. What are its basic components?
3. What is the difference between tilt-pad bearing and thrust bearing?
4. What is the function of case seals?
5. Describe the casing of a centrifugal compressor.

V. Grammar task. Open the brackets.

1. You (*a modal verb of obligation*) _____ cross the street on the green light.
2. A beautiful picture just (**draw**) _____ by my daughter.
3. I enjoy (**listen**) _____ to music.
4. If I didn't have you, I (**not/know**) _____ what to do.
5. The traffic was ... (*a degree of comparison of bad*) than we expected.
6. It's a hospital. You (*a modal verb of obligation/not*) _____ smoke here.
7. Mary has a toothache. She (**eat**) _____ sweets all day.
8. Charles and Margaret (**invite**) _____ to the wedding party yesterday.
9. I (**go**) _____ to the theatre this evening.
10. Did you take (*a little/many/little/lot*) _____ photographs when you were on holiday?

11. The President has a team of bodyguards (**protect**)_____ him.
12. Vanessa is a vegetarian. She (**eat/not**)_____ meat.
13. Venice is ... (*a degree of comparison of wonderful*) place I've ever visited.
14. The river (**flow**) _____ very fast today – faster than usual.
15. Their car broke down as they (**drive**) _____ home.
16. We (**not/get**) _____ there on time if we don't catch the bus.
17. I can't find my bag. You (**see**) _____ it?
18. We couldn't afford to keep our car, so we (**sell**)_____ it.
19. The museum was very crowded. There were too (*some/many/little/few*) _____ people.
20. It's too hot here. I (**open**) _____ the window.

UNIT 5. PIPELINE DESIGN

I. Read and translate the text.

The major steps in pipeline system design involve establishment of critical pipeline performance objectives and critical engineering design parameters such as: required throughput (volume per unit time for most petroleum products; pounds per unit time for petrochemical feed stocks); origin and destination points; product properties such as viscosity and specific gravity; topography of pipeline route; maximum allowable operating pressure (MAOP); and hydraulic calculations to determine: pipeline diameter, wall thickness, and required yield strengths; number of, and distance between, pump stations; and pump station horsepower required.

Safety in pipeline design and construction is achieved by the proper design and application of the appropriate codes and system hardware components. Design codes as set forth in U.S. Department of Transportation's (DOT's), Office of Pipeline Safety (OPS) regulations provide appropriate safety factors and quality control issues during construction. Metering stations and Supervisory control and data acquisition (SCADA) systems provide continuous monitoring oversight of pipeline

operations. Training of pipeline operating and maintenance personnel is also a key ingredient in the ongoing efforts to insure system integrity and safety. Safe operations result from developing and strictly adhering to standard procedures and providing the workforce with adequate training, safety devices, and appropriate personal protective equipment. Standard operating procedures typically are developed with reference to government and standard industry practices, as well as corporate safety policies, experience, philosophy, and business practices. Regulations promulgated by the Occupational Safety and Health Administration (OSHA) and by counterpart agencies at the state level specify the procedures and controls required to ensure workplace safety, including, in some instances, the performance of process safety analyses and the development of very specific procedures for activities thought to represent potentially significant hazards to workers and the public.

Corrosion-resistant coatings are applied to the exteriors of most pipes to inhibit corrosion. These may be applied at the manufacturing plant or a pipe coating plant located separately. However, coatings are also sometimes applied at the construction site. Even for precoated pipe, field dressings of joints and connections are also performed at the construction site just prior to burial. For particularly corrosive products (including some crude oils with high total acid numbers), pipes are also sometimes coated on the inside for corrosion resistance.

In addition to the resistance to corrosion they provide, some interior coatings are also designed to reduce frictional losses between the product and the interior walls of the pipe, thereby reducing the total amount of energy required to move the materials along the pipeline.

Protective wrappings, followed by the application of tape to the edges of the spirally applied overlapping wrapping, are often installed on the exterior of the pipe to further assist in corrosion control, but also to primarily protect the pipe from mechanical damage at installation. Wraps and tape often are impregnated with tar or other asphalt-based materials and heated in place once applied, to ensure uniform coverage. Once cured, the exterior coatings are chemically stable and environmentally inert, resisting degradation by soil moisture and bacteria, yet remaining sufficiently flexible that they continue to provide a protective coating on the pipe throughout a wide temperature range. Likewise, wrapping materials and tape are stable and inert (including toward the material be-

ing transported in the pipeline) and do not pose a potential for adverse environmental impacts.

Other coatings, such as thin-film epoxy and extruded polymers are also used as alternative to wraps and asphaltic coatings. Depending on local soil conditions, material of uniform size is sometimes imported to the construction site to form a bed on which the pipe is placed. The same material may also be installed around the sides and top of the pipe before the trench is filled with indigenous soils. Such bedding material serves two principal functions: protection of the pipe from mechanical to reduce damage during installation and trench filling, and stabilization of the pipe in the event of seismic shifts or frost heaves. Sands and gravels are typical bedding materials and are tamped in lifts of twelve to 18 inches per lift to ensure adequate compaction and avoid future subsidence. Bedding materials also assist in draining accumulated water from the vicinity of the pipe. All newly coated pipe used to transport hazardous liquids must be electrically inspected prior to backfilling to check for faults not observable by visual examination. Material faults such as micro cracks demonstrate a characteristic response to applied current when the detector is operated in accordance with the manufacturer's instructions and at the voltage level appropriate for the electrical characteristics of the coating system being tested [5].

Vocabulary

burial – заглубление, перекрытие породами;

compaction – уплотнение грунта;

construction site – место строительства, участок строительства;

Department of Transportation of the USA (DOT) – Министерство транспорта США

feed stock – исходное сырье, перерабатываемое сырье;

frost heave – поднятие грунта при промерзании;

hazardous – опасный, рискованный, вредный, аварийный;

hydraulic calculation – гидравлический расчет;

impregnate with tar – просмаливать;

indigenous soil – местная почва, образовавшаяся из местной материнской породы;

inhibit corrosion – предотвращать коррозию;

maximum allowable operating pressure (MAOP) – максимальное допустимое давление;
 metering station – станция измерения потребления газа;
 Office of Pipeline Safety (OPS) – Управление безопасности нефтепроводов;
 The Occupational Safety and Health Act (OSHA) – Закон о технике безопасности и гигиене труда;
 pipeline system – система трубопроводов;
 petroleum products – нефтепродукты;
 product properties – свойства продукта;
 promulgate – вводить в действие;
 protective wrapping – защитная упаковка;
 pump station horsepower – мощность насосной станции;

safety factors – коэффициент запаса прочности;
 soil moisture – влагоемкость почвогрунта;
 specific gravity – удельная плотность;
 subsidence – оседание, проседание;
 Supervisory control and data acquisition (SCADA) system – промышленная система диспетчерского управления и сбора данных;
 trench – шламочапан, траншея трубопровода;
 throughput – производственная мощность;
 viscosity – вязкость;
 wall thickness – толщина стенки трубопровода;
 yield strength – предел текучести

II. Find 9 words from the unit:

L	T	H	R	O	U	G	H	P	U	T	T	Y	S	D	P
T	W	S	F	E	E	D	S	T	O	C	K	Y	G	R	I
R	Q	O	I	N	I	T	I	A	T	I	O	N	A	I	P
E	U	V	I	S	C	O	S	I	T	Y	S	H	R	L	E
N	A	H	O	R	S	E	P	O	W	E	R	R	G	L	L

C	R	B	U	R	I	A	L	I	T	Y	I	N	I	N	I
H	P	S	U	B	S	I	D	E	N	C	E	A	B	E	N
G	Y	A	H	A	Z	A	R	D	O	U	S	L	I	T	E

III. Read the text once again and answer the following questions.

1. What are the major steps in pipeline system?
2. How is safety in pipeline design and construction achieved?
3. What systems provide continuous monitoring oversight of pipeline operations?
4. Describe corrosion-resistant coatings.
5. What protective wrappings are installed on the exterior of the pipe?
6. What other coatings are installed on the exterior of the pipe?
7. What is the purpose of bedding materials?

IV. Grammar task. Open the brackets.

1. _____ Walter (like) _____ comedies?
2. When Tim was 16, he was a fast runner. He (*a modal verb of ability*) _____ run 1000 meters in 11 seconds.
3. Please stop (**ask**) _____ me questions!
4. He had very (*some/a few/little/many*) _____ information on the subject and could add nothing.
5. I don't think I (**go out**) _____ tonight. I'm too tired.
6. If she studied harder, she (**get**) _____ better marks.
7. Health and happiness are ... (*a degree of comparison of important*) than money.
8. The hotel wasn't very expensive. It (**not/cost**) _____ very much.
9. It's ... (*a degree of comparison of expensive*) car we've ever bought.
10. 'Don't forget to e-mail the letter, will you?' 'I already (**send**) _____ it.'
11. Hello, Tom. I (**look**) _____ for you all morning. Where have you been?

12. She (**wear**) _____ a red pullover and black jeans today.
13. This book (**write**) _____ by Agatha Christie.
14. This time last year we (**lie**) _____ on the beach.
15. It was late, so we decided (**take**) _____ a taxi home.
16. We can't buy (*any/few/a little/ lot*) _____ posters in this shop.
17. The art exhibition (**open**) _____ on 3 May and finishes on 15 July.
18. You (*a modal verb of obligation*) _____ keep it a secret. Don't tell anyone.
19. You need not clean the bathroom. It already (**clean**) _____ by my mother.
20. You'll learn a lot about American history if you (**visit**) _____ the exhibition.

UNIT 6. STORAGE TANKS TYPES

I. Read and translate the text. Make up the plan.

Tanks are usually described according to their function or their construction.

Their function may be receiving, settling, treating, dehydrating, washing, desalinating, storing or exporting. The construction is limited to two main categories: fixed-roof tanks and floating-roof tanks.

Fixed-roof tanks are tanks which have their cylindrical shell covered by a roof that is an integral part of the tank construction. The roof plates rest on a supporting framework and are attached to the tank only at the top of the shell.

There are three types of fixed-roof tanks: a. Non-pressure tanks which are in open connection with the atmosphere by vents installed in the roof; b. Low-pressure tanks where instead of vents, pressure valves have been installed which open at pressures of 20 mbar over and 6 mbar under atmospheric pressure; c. High- pressure tanks on which pressure valves open at design pressures of 50 mbar over and 6 mbar under atmospheric pressure.

The evaporation losses inherent with fixed-roof tanks can be almost entirely eliminated by the use of floating roofs. They rise or fall with the oil level. In the design of a floating-roof two loading possibilities have been considered: a. Oil leakage of the roof; b. Rainwater accumulation on the roof. It should be noted that floating roofs are not designed for a combination of leakage and rainwater accumulation. This means that the operator must avoid rainwater accumulation if the roof has any leaking pontoons. Floating-roofs are completely welded structures, which are fabricated on site.

The following types can be distinguished: a. Pontoon roofs; b. Double deck roofs Pontoon Roofs. In most cases the pontoon-type roof is used. The centre deck, made up of 5 mm thick lap-welded plates, is welded to the inner side of the annular pontoon, which provides the buoyancy.

The surface of the pontoon is 20-25% of the total roof surface. The pontoon is built of compartments which are separated from each other by liquid tight bulkheads. This ensures that a leakage in one of the compartments will be limited to that particular compartment. For large diameter tanks, e.g. over 50 metres, special types of floating-roofs are sometimes used.

In a number of cases double-deck roofs (double-deck over the whole liquid surface) are used instead of pontoon roofs. For this type of roof the lower deck rests on the liquid and some distance above this, the upper deck rests on the lower deck, supported by bulkheads and supporting, concentric rings. The air space between the two decks provide an effective insulation against solar radiation. The upper deck has a slight incline towards the centre of the roof. For very large roofs even a double incline may be used [6].

Vocabulary

annular – затрубный, кольцевой;

buoyancy – выталкивательная сила;

dehydrating – дегидратация;

desalinating – обессоливание;

evaporation losses – потери на парообразование;

fixed-roof tanks – резервуар с фиксированной крышей;

floating-roof tanks – резервуар с плавающей крышей;

liquid-tight bulkhead – непроницаемый распределительный блок;
 mbar – миллибар;
 oil level – высота налива нефтепродукта;
 pontoon – понтон, короб, отсек плавающей крыши резервуара;
 pressure valves – нагнетательные клапаны;
 rainwater accumulation – скапливание дождевой воды;
 solar radiation – солнечное облучение;
 storage tank – резервуар хранения нефти или нефтепродуктов;
 supporting framework – несущая конструкция;
 vent – выпор, дренаж, выпускное отверстие, канал в головке керно-приемной трубы, факел для сжигания попутного газа;
 welded structure – сварная конструкция.

II. Answer the following questions.

1. What are the functions of storage tanks?
2. What are two main categories of storage tanks?
3. What are the main characteristics of fixed-roof tanks?
4. How many loading possibilities are there in the design of a floating roof? Can you name them?
5. What are the characteristics of a pontoon roof?

III. Match the left and the right.

1.fixed-roof	a) shell
2.integral	b) tanks
3.open	c) construction
4.tank	d) valves
5.atmospheric	e) framework
6.rainwater	f) level
7centre	g) pressure
8.floating-roof	h) possibilities
9.particular	i) deck
10.pressure	j) tanks
11.loading	k) compartment
12.double-deck	l) roofs
13.supporting	m) accumulation

14.oil	n) connection
15.cylindrical	o) part

IV. Complete the sentences with the missing words.

incline, supporting framework evaporation losses, construction, solar radiation, buoyancy, cylindrical

1. The air space between the two decks provide an effective insulation against _____.
2. The upper deck has a slight _____ towards the centre of the roof.
3. The centre deck, made up of 5 mm thick lap-welded plates, is welded to the inner side of the annular pontoon, which provides the _____.
4. The _____ inherent with fixed-roof tanks can be almost entirely eliminated by the use of floating roofs.
5. Fixed-roof tanks are tanks which have their _____ shell covered by a roof that is an integral part of the tank construction.
6. The _____ is limited to two main categories: fixed-roof tanks and floating-roof tanks.
7. The roof plates rest on a _____ and are attached to the tank only at the top of the shell.

V. Grammar task. Open the brackets.

1. Have you finished (**wash**) _____ your hair yet?
2. 'What you (**do**) _____ this time yesterday?' 'I was asleep.'
3. My grandmother loved music. She (*a modal verb of ability*) _____ play the piano very well.
4. If you study harder, you ... (**pass**) your exam successfully.
5. He spoke (*many/much/little/a lot*) _____ English, so it was difficult to communicate with him.
6. _____ the film (**begin**) _____ at 3.30 or 4.30?

7. This coffee is very weak. I like it a bit ... (*a degree of comparison of strong*).
8. I'm tired. I (**go**) _____ to bed now. Goodnight!
9. The sun (**rise**) _____ in the east.
10. Mozart (**write**) _____ more than 600 pieces of music.
11. Did it cost (*very few/ a little/much/ a lot*) _____ to repair the car?
12. What is ... (*a degree of comparison of long*) motorway in the UK?
13. He told me his name but I (**forget**) _____ it.
14. This house is quite old. It (**build**) _____ in 1930.
15. We've got plenty of time. We (*a modal verb of absence of necessity*) _____ hurry.
16. 'How did the thief get into the house?' 'I forgot (**shut**) _____ the window.'
17. Tim is still watching TV. He (**watch**) _____ TV all day.
18. We (**go**) _____ to a concert tonight. It begins at 7.30.
19. If you (**take**) _____ more exercise, you would feel healthier.
20. A decision (**not/make**) _____ until the next meeting.

UNIT 7. OIL AND GAS PROCESSING EQUIPMENT MANUFACTURERS

I. Read and translate the text.

Shaanxi Gaoton Highlong Machinery Co., LTD. is a dynamic and vigorous Chinese supplier in the Oil and Gas, water well, construction, geothermy, power generation industry.

Its products cover American Petroleum Institute certificated Wellhead Equipments, Handling Tools, Rig & Accessories, Mud Pumps & Spare Parts, Cementing Equipment, Down hole Tools, Solid Control Equipments, etc. Also, with the professional technical team, they could supply customized products.

Superior quality, competitive price, timely service and professional technical support lead the company to go further with their international customers in Russia, Venezuela, Mexico, Iran, United Arab Emirates, India, Egypt, Kazakhstan, Australia, Korea, US., etc.

The mission of the company is to exceed quality expectation with the highest integrity, strive to provide excellent customer service and continue to excel within the industry.

Golden Eagle Petroleum Equipment (Beijing) Co., Ltd. is an international, integrated oil and gas (Golden Eagle Holdings Group) corporation specializing in drilling equipment manufacturing and Directional Drilling technology services. It provides innovative solutions and maintenance to onshore and offshore drilling rigs for its global customers. With more than twenty years' development, the company has six joint-venture manufacturing plants and seven international branch offices in Oman, Azerbaijan, US, Saudi Arabia, Pakistan, Algeria and United Arab Emirates.

Golden Eagle Holding is a large-scale listed corporate group specializing in high-level petroleum equipment and integrated oil services for petroleum and natural gas development, headquartered in Beijing of China, currently has more than six production bases and six business branch organizations covering major energy markets across the world.

Golden Eagle Holding has always served clients with differentiated and advanced products of high quality in conjunction with global service networks. The company strives to become an internationally competitive oilfield equipment and services supplier and to offer maximum value to global clients.

Manufacturing and engineering company ENCE GmbH («ЭНЦЕ ГМХ») (Switzerland) has been successfully engaged in oil and gas, petrochemical, metallurgy, ore-dressing, machinery construction and power industries, during over 20 years specializing in research and looking for nonstandard, efficient and energy-saving solutions.

ENCE GmbH («ЭНЦЕ ГМХ») appears to be a joint owner of BUKANG machine building plant located in the Republic of Korea, that promotes development and manufacture of especially critical units of equipment, shut-off and control valves for corrosive and abrasive mediums as well as complex and heatproof components made of special steel, alloys, bronze and ceramics.

Engineering company INTECH GmbH / ИНТЕХ ГмбХ, Moscow, Russia was established on the 18th of February, 1997. The mission of the company is putting into operation new industrial facilities based on advanced engineering solutions, upgrading and equipping enterprises in Russia and other CIS countries with reliable innovative equipment, surpassing clients' expectations at each stage of cooperation: starting from engineering solutions to equipment supplied and after-sales service.

The company's main objectives are implementation of engineering projects for industrial enterprises of Russia (Moscow, Ural (Nizhny Tagil), Bashkortostan (Ufa), Lipetsk, Cherepovez), as well as for enterprises of CIS countries: Kazakhstan (Almaty, Atyrau), Uzbekistan (Tashkent), the Ukraine (Kiev), Baltic region, Belarus, Turkmenistan using advanced energy-saving technologies and high efficiency equipment. The company also modernizes existing equipment and ensures its extended life on the processing plants, as well as replace the obsolete and worn-out equipment in the production processes.

The main goals of the company are as follows: to timely spot the customer's problem, then search the solution; to supply the equipment right on time, as well as to provide the highest service and to completely meet the demands of its customers [7, 8, 9, 10].

Vocabulary

after-sales service – гарантийное обслуживание;

branch offices – филиалы компании;

CIS (Commonwealth of Independent States) countries – страны Содружества Независимых Государств (СНГ);

competitive price – конкурентоспособная цена;

customized products – товары, изготовленные по индивидуальному заказу;

energy-saving technologies – энергосберегающие технологии;

extended life – увеличенный срок службы;

handling tools – инструменты для спуско-подъемных работ, инструменты для работы с трубами;

heat proof components – теплостойкие компоненты;

implementation – исполнение, реализация, внедрение;

innovative solutions – инновационные решения;

joint-venture – совместное предприятие;
 LTD (private limited company) – закрытая акционерная компания;
 manufacturing plants – заводы-изготовители;
 meet the demands of the customers – удовлетворять требованиям покупателей, соответствовать спросу покупателей;
 obsolete and worn-out equipment – морально и физически устаревшее оборудование;
 ore-dressing – механическая обработка руды, обогащение руды;
 processing plant – нефтехимический завод;
 put into operation – вводить в эксплуатацию;
 shut-off and control valves – отсекающие (запорные) и распределительные (регулирующие) клапаны;
 strive – стремиться, прилагать усилия;
 superior quality – превосходное качество;
 supplier – компания-поставщик;
 timely service – своевременное, оперативное обслуживание;
 vigorous – энергичный, активный, мощный;
 wellhead equipment – устьевая арматура.

II. Read the text again and answer the questions.

1. Name the main oil and gas processing equipment manufacturers.
2. What equipment does Shaanxi Gaoton Highlong Machinery Company produce?
3. What are the missions of the companies mentioned in the text?
4. Describe the Golden eagle Petroleum Equipment Company.
5. What are the main objectives and the main goals of the Engineering company INTECH GmbH.
6. Name other Russian companies producing oil and gas processing equipment.
7. Name other foreign companies producing oil and gas processing equipment.

III. Answer the following questions:

1. What University do you study at? What do you know about your University?
2. What faculty do you belong to? When was it founded?

3. What qualifications will you get after graduation?
4. What subjects does the academic program consist of?
5. Which subjects are among your favorite ones at university?
6. When did you start to think about your future profession? Who helped you to make your choice?
7. Why is the profession of a specialist in oil and gas processing equipment important?
8. What are you going to do after your graduation? What job would you like to have?
9. What are the career prospects of your future profession?

IV. These are headings and categories commonly used in CVs.

Marital status, referees, employment history, permanent address, educational background, skills, title, personal details, hobbies and interests, full name, qualifications, date of birth.

Which one means:

- a) basic facts about you?
- b) practical abilities?
- c) where you live most of the time?
- d) what you do in your free time?
- e) Mr, Mrs, Ms, or Dr?
- f) when you were born?
- g) details about your working experience?
- h) if you are married or single?
- i) people who can tell us about your qualities and character?
- j) proof that you have successfully completed a course?
- k) schools and college?
- l) name and surname?

V. Study the list of things which are important in a job. Choose the three which are most and least important for you.

- opportunities for promotion

- comfortable working conditions
- status and respect
- interesting and satisfying work
- fringe benefits (e. g. company car, private health insurance)
- a good salary
- extended holidays
- colleagues I like
- a fair and reasonable boss
- training opportunities
- job security

VI. Write your own CV.

VII. Grammar task. Open the brackets.

1. He isn't very popular. He has (very few/a little/much/a lot) _____ friends.
2. The weather is too cold in this country. I'd like to live somewhere ... (a degree of comparison of **warm**).
3. It's very cold this morning. I (a modal verb of advice) _____ wear a coat when you go out.
4. '_____ Colin (**work**) _____ this week?' 'No, he's on holiday.'
5. Could you please stop (**make**) _____ so much noise?
6. That was ... (a degree of comparison of **delicious**) meal I've had for a long time.
7. _____ this room (**clean**) _____ every day?
8. What would you do if you (**win**) _____ a million dollars?
9. How fast you (**drive**) _____ when the accident happened?
10. 'Is Sally here?' 'No, she (**go**) _____ out.'
11. I (a modal verb of necessity) _____ get up early. There are a lot of things I want to do.
12. Where have you been? I (**look**) _____ for you for twenty minutes.

13. 'Did you phone Ruth?' 'Oh no, I forgot. I (**phone**) _____ her now.'
14. Paul and I played tennis yesterday. He's much better than me, so he (**win**) _____ easily.
15. Susan won't get into university unless she ... (**get**) good grades.
16. The room (**clean**) _____ at the moment.
17. Most of the town is modern. There are (*many/ much/few /a lot*) _____ old buildings.
18. The baby began (**cry**) _____ in the middle of the night.
19. An atheist (**not/believe**) _____ in God.
20. The train (**leave**) _____ Plymouth at 11.30 and arrives in London at 14.45.

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