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ИНОСТРАННЫЙ ЯЗЫК

Технологические машины и оборудование (Оборудование нефтегазопереработки)

Методические указания к самостоятельной работе для студентов направления подготовки 15.03.02

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

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ИНОСТРАННЫЙ ЯЗЫК. ТЕХНОЛОГИЧЕСКИЕ МАШИНЫ И ОБОРУДОВАНИЕ (ОБОРУДОВАНИЕ НЕФТЕГАЗОПЕРЕРАБОТКИ): Методические указания к самостоятельной работе / Санкт-Петербургский горный университет. Сост.: *Е.В. Картер, Э.Р. Скорнякова*. СПб, 2021. 33 с.

Методические указания предназначены для студентов направления подготовки 15.03.02 «Технологические машины и оборудование (Оборудование нефтегазопереработки)». Предлагаемый материал направлен на активизацию студентами лексико-грамматического материала на английском языке в области профессиональных интересов. Методические указания к самостоятельной работе включают творческие и развивающие задания, рассчитанные на закрепление профессиональной лексики. Каждый текст нацелен на развитие познавательный деятельности студентов, может служить основой для активизации мыслительной деятельности и критического мышления.

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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 (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 рассматриваются основные технологические машины и оборудование нефтегазопереработки.

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 «Технологические машины и оборудование (Оборудование нефтегазопереработки»).

UNIT 1. SEPARATORS

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

Separator, pressure vessel, oil and gas well, production fluid, producing lease, wellhead, manifold, tank battery, gaseous and liquid components, primary separation device, volumetric liquid capacity, oil level, liquid surge, liquid-level controller, stratify.

II. Read and translate the following text.

The term separator in oilfield terminology designates a pressure vessel used for separating well fluids produced from oil and gas wells into gaseous and liquid components. A separator for petroleum production is a large vessel designed to separate production fluids into their constituent components of oil, gas and water. A separating vessel may be referred to in the following ways: Oil and gas separator, Separator, Stage separator, Trap, Knockout vessel (Knockout drum, knockout trap, water knockout, or liquid knockout), Flash chamber (flash vessel or flash trap), Expansion separator or expansion vessel, Scrubber (gas scrubber), Filter (gas filter). These separating vessels are normally used on a producing lease or platform near the wellhead, manifold, or tank battery to separate fluids produced from oil and gas wells into oil and gas or liquid and gas. An oil and gas separator generally includes the following essential components and features:

1. A vessel that includes (a) primary separation device and/or section, (b) secondary "gravity" settling (separating) section, (c) mist extractor to remove small liquid particles from the gas, (d) gas outlet, (e) liquid settling (separating) section to remove gas or vapor from oil (on a three-phase unit, this section also separates water from oil), (f) oil outlet, and (g) water outlet (three-phase unit).

2. Adequate volumetric liquid capacity to handle liquid surges (slugs) from the wells and/or flowlines.

3. Adequate vessel diameter and height or length to allow most of the liquid to separate from the gas so that the mist extractor will not be flooded.

4. A means of controlling an oil level in the separator, which usually includes a liquid-level controller and a diaphragm motor valve on the oil outlet.

5. A back pressure valve on the gas outlet to maintain a steady pressure in the vessel.

6. Pressure relief devices.

Separators work on the principle that the three components have different densities, which allows them to stratify when moving slowly with gas on top, water on the bottom and oil in the middle. Any solids such as sand will also settle in the bottom of the separator. The functions of oil and gas separators can be divided into the primary and secondary functions.

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

verb	noun	adjective/participle
designate		
	production	
		separating
refer		
	function	
stratify		

IV. Answer the following questions:

1. What does the term “separator” in oilfield terminology designate?
2. What is a separator for petroleum production?
3. What may a separating vessel be referred to?
4. Where are the separating vessels normally used on?
5. What principle do separators work on?
6. What solids will also settle in the bottom of the separator?

V. Match the left and the right columns:

1. separate production fluids into	a) a producing lease or platform near the wellhead
2. can be divided into	b) from the gas
3. a pressure vessel used for	c) on the oil outlet
4. maintain	d) with gas on top
5. are normally used on	e) their constituent components of oil, gas and water
6. remove small liquid particles	f) a steady pressure in the vessel
7. handle liquid surges	g) separating well fluids
8. settle in	h) the primary and secondary functions
9. a diaphragm motor valve	i) from the wells
10. when moving slowly	j) the bottom of the separator

VI. Insert the missing words and expressions:

Adequate volumetric liquid capacity, diaphragm motor valve, mist extractor, gas outlet, devices, steady pressure

1. A vessel that includes (a) primary separation device and/or section, (b) secondary "gravity" settling (separating) section, (c) mist extractor to remove small liquid particles from the gas, (d) _____, (e) liquid settling (separating) section to remove gas or vapor from oil (on a three-phase unit, this section also separates water from oil), (f) oil outlet, and (g) water outlet (three-phase unit).
2. _____ to handle liquid surges (slugs) from the wells and/or flowlines.
3. Adequate vessel diameter and height or length to allow most of the liquid to separate from the gas so that the _____will not be flooded.
4. A means of controlling an oil level in the separator, which usually includes a liquid-level controller and a _____ on the oil outlet.

5. A back pressure valve on the gas outlet to maintain a _____ in the vessel.
6. Pressure relief _____.

VII. Fill in the gaps with the appropriate tense-aspect forms of the verbs.

Oil and gas separators can (*have*) three general configurations: vertical, horizontal, and spherical. Horizontal oil and gas separators (*manufacture*) with monotube and dual-tube shells. Monotube units (*have*) one cylindrical shell, and dual-tube units (*have*) two cylindrical parallel shells with one above the other. Both types of units can (*use*) for two-phase and three-phase service. A monotube horizontal oil and gas separator usually (*prefer*) over a dual-tube unit. The monotube unit (*have*) greater area for gas flow as well as a greater oil/gas interface area than (*be*) usually available in a dual-tube separator of comparable price. The monotube separator will usually (*afford*) a longer retention time because the larger single-tube vessel (*retain*) a larger volume of oil than the dual-tube separator. It (*be*) also easier to clean than the dual-tube unit. In cold climates, freezing will likely (*cause*) less trouble in the monotube unit because the liquid (*be*) usually in close contact with the warm stream of gas flowing through the separator. The monotube design normally (*have*) a lower silhouette than the dual-tube unit, and it (*be*) easier to stack them for multiple-stage separation on offshore platforms where space (*limit*). Vertical separators should (*construct*) such that the flow stream (*enter*) near the top and (*pass*) through a gas/liquid separating chamber even though they (*be)* not competitive alternatives unlike the horizontal separators.

VIII. Insert the missing prepositions:

Out, for, in, from, on, under, with, of

Effective oil-gas separation is important not only to ensure that the required export quality is achieved but also to prevent problems ___ downstream process equipment and compressors. Once the bulk liquid has been knocked ___, which can be achieved in many ways, the remaining liquid droplets are separated ___ by a demisting device. Until recently the main technologies used ___ this application were reverse-flow cyclones, mesh pads and vane packs. More recently new devices ___ higher gas-handling have been developed which have enabled potential reduction in the scrubber vessel size. There are several new concepts currently ___ development in which the fluids are degassed upstream ___ the primary separator. These systems are based ___ centrifugal and turbine technology and have additional advantages in that they are compact and motion insensitive, hence ideal for floating production facilities.

IX. Choose one of the listed topics, find more information and speak about it.

1. Primary functions of oil and gas separators.
2. Secondary functions of oil and gas separators.
3. Methods used to remove oil from gas in separators
4. Methods used to remove gas from oil in separators
5. Flow measurements in oil and gas separators
6. Flow calibration in oil and gas separators
7. Controls for oil and gas separators
8. Accessories for oil and gas separators
9. Safety features for oil and gas separators
10. Operation and maintenance considerations for oil and gas separators

UNIT 2. EVAPORATION PLANTS

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

Evaporation plants are often used for the further processing of raw extracts from extraction plants, to separate the alcoholic solvents. In the recovery of ethanol following vanilla extraction, for example, most of

the ethanol is collected in the more volatile phase, which can then be further processed during rectification. The less volatile phase contains the vanilla extract for the customer and only a very small amount of ethanol.

Evaporation plant construction types:

Bubble evaporator (batch process)

A liquid product-solvent mixture is heated in a heated stirrer tank (bubble evaporator) until the solvent evaporates. The faster boiling component accumulates in the vapor, which is continuously drawn off along with the vapor and liquefied in the downstream condenser. The remaining concentrate (sump product) is evaporated until it reaches the proportion of solvent specified by the customer. Thanks to the precisely adjustable evaporation temperatures, this process allows a high final concentration to be achieved, however, the process is very time-consuming due to the small evaporation surface. Bubble evaporators are often used in the production of plant extracts in the flavor and tobacco industry.

Falling film evaporator (continual process)

A liquid product-solvent mixture is distributed at the top of the heating tubes, running down the inner tube walls as a fine film. The tubes are heated at the outer wall, causing the liquid film to boil and evaporate off. The more concentrated product-solvent mixture and the solvent vapors are separated from one another in the downstream separator. This process is repeated several times until the specified concentration is achieved. Fouling on the inside of the tubes is prevented by the downward flow of the liquid film. Falling film evaporators are often used for large throughputs and free-flowing final concentrates, e.g. milk or juices.

Circulating evaporator as natural circulation evaporator or forced circulation evaporator with tube heat exchanger or plate heat exchanger (continual process)

The process is identical to that of the falling film evaporator, with the difference that the tubes are filled with the product-solvent mixture. The risk of fouling is higher due to the lower flow velocity, however, manufacturing costs are lower. Circulation evaporation is the preferred method for plant extracts in flavor production.

Thin film evaporator (continual process)

A liquid product-solvent mixture is directed from above onto the inner wall of the vertical tank and applied as a film by an agitator with wall-mounted stirring blades. The solvent evaporates on the heated tank wall and is collected in a downstream condenser. The evaporated product is then removed from the evaporator at the desired concentration. Thin film evaporators enable significantly higher final concentrations of highly viscous products to be achieved at low throughput rates. As this process is very gentle, it is often used for active ingredients in the pharmaceutical and cosmetics industries.

II. Answer the questions.

1. What are evaporation plants often used for?
2. What mixture is heated in a heated stirrer tank until the solvent evaporates?
3. Where does the faster boiling component accumulate?
4. Why is the process very time-consuming?
5. Where is a liquid product-solvent mixture distributed?
6. What is fouling on the inside of the tubes prevented by?
7. What are falling film evaporators often used for?

III. Mark the sentences as True or False.

1. The more volatile phase contains the vanilla extract for the customer and only a very small amount of ethanol.
2. The remaining concentrate (sump product) is evaporated until it reaches the proportion of solvent specified by the customer.
3. Bubble evaporators are often used in the production of plant extracts in the flavor, coffee and tobacco industry.
4. The tubes are heated at the outer wall.
5. The risk of fouling is higher due to the higher flow velocity.

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

verb	noun	adjective/participle

collect		
	process	
		heated
evaporate		
	concentrate	
	rectification	

V. Insert the missing words and expressions:

Adjustable evaporation temperatures, in the downstream separator, more volatile phase, large throughputs, the specified concentration

1. In the recovery of ethanol following vanilla extraction, for example, most of the ethanol is collected in the_____, which can then be further processed during rectification.
2. Thanks to the precisely _____, this process allows a high final concentration to be achieved.
3. The more concentrated product-solvent mixture and the solvent vapors are separated from one another _____.
4. This process is repeated several times until _____ is achieved.
5. Falling film evaporators are often used for _____ and free-flowing final concentrates.

VI. Match the left and the right columns.

1. the preferred method for	a) along with the vapor
2. the further processing of	b) boil and evaporate off
3. applied as a film by	c) final concentrations
4. drawn off	d) as a fine film
5. collected in	e) the pharmaceutical and cosmetics industries
6. running down the inner tube walls	f) at the desired concentration
7. removed from the evaporator	g) a downstream condenser

8. causing the liquid film to	h) raw extracts from extraction plants
9. enable significantly higher	i) plant extracts
10. active ingredients in	j) an agitator

VII. Insert the missing prepositions:

At, for, in, from, on, with, of, above

A liquid product-solvent mixture is directed from ___ onto the inner wall of the vertical tank and applied as a film by an agitator ___ wall-mounted stirring blades. The solvent evaporates ___ the heated tank wall and is collected ___ a downstream condenser. The evaporated product is then removed ___ the evaporator ___ the desired concentration. Thin film evaporators enable significantly higher final concentrations ___ highly viscous products to be achieved at low throughput rates. As this process is very gentle, it is often used ___ active ingredients in the pharmaceutical and cosmetics industries.

UNIT 3. MIST EXTRACTORS

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

Mist extractors can be made of wire mesh, vanes, centrifugal force devices, or packing. Wire mesh pads are made of finely woven mats of stainless steel wire wrapped into a tightly packed cylinder. The liquid droplets impinge on the matted wires and coalesce. The effectiveness of wire mesh depends largely on the gas being in the proper velocity range. If the velocities are too high, the liquids knocked out will be re-entrained. If the velocities are low, the vapor just drifts through the mesh element without the droplets impinging and coalescing.

The construction is often specified by calling for a certain thickness (usually 3 to 7 inches) and mesh density (usually 10 to 12 pounds

per cubic foot). Experience has indicated that a properly sized wire mesh eliminator can remove 99% of 10-micron and larger droplets. Although wire mesh eliminators are inexpensive, they are more easily plugged than the other types. Vane eliminators force the gas flow to be laminar between parallel plates that contain directional changes. In vane eliminators, droplets impinge on the plate surface where they coalesce and fall to a liquid collecting spot. They are routed to the liquid collection section of the vessel. Vane-type eliminators are sized by their manufacturers to assure both laminar flow and a certain minimum pressure drop.

Some separators have centrifugal mist eliminators that cause the liquid drops to be separated by centrifugal force. These can be more efficient than either wire mesh or vanes and are the least susceptible to plugging. However, they are not in common use in production operations because their removal efficiencies are sensitive to small changes in flow. In addition, they require relatively large pressure drops to create the centrifugal force. To a lesser extent, random packing is sometimes used for mist extraction. The packing acts as a coalescer.

II. Answer the questions.

1. What can mist extractors be made of?
2. What does the effectiveness of wire mesh depend largely on?
3. What is the construction often specified by?
4. What do vane eliminators force?
5. Why are separators with centrifugal mist eliminators not in common use in production operations?

III. Mark the sentences as True or False.

1. Wire mesh pads are made of finely woven mats of stain steel wire wrapped into a tightly packed cylinder.
2. If the velocities are too low, the liquids knocked out will be re-entrained.
3. Experience has indicated that a properly sized wire mesh eliminator can remove 99% of 10-micron and larger droplets.
4. Vane-type eliminators are sized by their manufacturers to assure only laminar flow.

5. Some separators have centrifugal mist eliminators that cause the liquid drops to be separated by centrifugal force.

IV. Insert the missing words and expressions:

The mesh element, random packing, susceptible, liquid collecting spot, wires and coalesce, vessel, inexpensive

1. The liquid droplets impinge on the matted _____.
2. If the velocities are low, the vapor just drifts through _____ without the droplets impinging and coalescing.
3. Although wire mesh eliminators are _____, they are more easily plugged than the other types.
4. In vane eliminators, droplets impinge on the plate surface where they coalesce and fall to a _____.
5. They are routed to the liquid collection section of the _____.
6. These can be more efficient than either wire mesh or vanes and are the least _____ to plugging.
7. To a lesser extent, _____ is sometimes used for mist extraction.

V. Match the synonyms:

1. cause	a) capability
2. separate	b) rely upon
3. effectiveness	c) difference
4. depend on	d) result in
5. change	e) receptive
6. common	f) effective
7. efficient	g) demand
8. require	h) divide
9. susceptible	i) usual

VI. Find 9 words from the unit:

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

UNIT 4. SCREENS

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

Screen, sand control, gas producing wells, stand alone screens, slotted liner, wire-wrapped screen, prepacked screen and premium screen, expandable sand screen, keystone slots, gravel pack, well-sorted formations, filter media.

II. Read and translate the text.

Sand control is a method to control sand production into a wellbore. This is common requirement for several oil and gas producing wells around the world. There are two situations which cause sand production. The first cause is rock mechanical failure near wellbore and the second one is dragging force from producing or injection fluid. Sand production can lead to several issues such as production impairment due to sand plugging, erosion to completion string and down hole tool, damage sur-

face facilities as separator, piping, etc. In order to avoid sand production, there are two main methods as listed below:

Passive sand control

This method uses non-intrusive measures to control, mitigate or avoid sand production from the reservoir. The following techniques are passive sand control methods:

- Oriented perforation
- Selective perforation
- Sand management

Active sand control

This method relies on the use of filters to control sand production and it is known as intrusive measure. The following techniques are active sand control methods.

- Stand alone screens (slotted liner, wire-wrapped screen, pre-packed screen and premium screen)
- Expandable sand screen

Stand alone screens

This type of sand control is to put a screen to stop sand production into a wellbore. Initially, fine sand and silts will pass through the screen. Once sand packs are developed around the screen, they will be like a filtration media which prevents sand to flowing into a wellbore. There are several types of screens used in oil and gas industry, such as slotted liner, wire-wrapped screen, prepacked screen and premium screen. This is suitable for well-sorted, clean with large grain size formation.

Slotted liner, which is one of the oldest sand control methods, is tubing with series of slots cut through a wall of tubular in an axial orientation. Width of slots is design to create inter-particle bridging across the slots. This is the least expensive way of making a standalone screen and it is very simple. The flow area is average about 3%, but it can go up to 6% of total area of pipe. However, flow areas over 6% will be detrimental to pipe tensile strength.

There are two types of slots which are straight and keystone slots. Keystone slots are considered to be a better choice than straight slots because of their self-flush ability. However, keystone slots are generally more expensive than straight slots. In general, slots are 1.5 to 2.5 inches long and width varies from 0.012 to 0.250 inches.

Wire wrapped screen is a perforated pipe with a wire-wrapped jacket welded around. Wires wrapped around the vertical ribs are keystone shaped, which is designed for decreasing the chances of sand plugging the screen because it has a self-cleaning action. It has a bigger flow area in comparison to a slotted liner and it provides good strength and accurate slot opening area.

There are three main types of wire-wrap screens as listed below:

- Rod-based screens
- Pipe-based slip-on
- Pipe-based direct build screens.

The wire-wrapped screen can be used as a standalone screen or used with a gravel pack. The critical part of having successful sand control with wire-wrapped screen is to have well-sorted formations. Poorly sorted formation will not be effective because fine particles will pass through the screen, whereas the big particles are blocked. Fine particles in a wellbore will flow with producing fluid and cause damage to downhole and surface equipment. In a poorly sorted reservoir, the wire-wrapped screens are typically used behind a gravel pack because a gravel pack is well-sorted grain size that people can control.

Pre-packed screen is similar to a wire-wrapped screen but it has different filtering media. A media gravel layer with or without resin coating is placed around the internal screen component and is supported by an external screen. Thickness and size of a medium layer depend on well requirements, such as formation size, flow rate, hole size, etc. The main concern about the pre-packed screen is a chance of plugging it with completion fluid, drilling mud, etc. Therefore, in order to mitigate this issue, Carbolite proppant can be utilized as the main pack media rather than re-sieved gravel. There are several advantages about Carbolite such as bigger pore throats, precise sorting grain size, and better permeability than normal re-sieved sand.

Premium screens are an all metal design with a protective outer metal shroud and a metal mesh filtration. The main advantages of premium screens over other screens are screen plugging resistance and ability to flow back drilling fluid through the screens. The metal mesh can be specially designed depending on each service providers or customer requirements. Pore throat can vary from 60 micron to 300 micron and the ideas it that the mesh will prevent large particles and allow fine particles

to flow through at the initial stage. Then large particles will form a permeable sand filter cake layer on the surface of screen, which will prevent fine and large particle from flowing though. Premium screens are normally run behind gravel pack and they are famous for running in long horizontal wells.

Expandable screen is the latest screen technology. It includes perforated pip, a filter media and an outer shroud. The screen is run in to a wellbore and the expansion insert is used to expand the screen to the production hole diameter.

The advantages of setting expandable screens against formation are as follows;

- Effective sand control
- Provides wellbore support
- Gives maximum hole diameter
- Gives a high inflow area

Typical expandable screen is consisted of four main parts:

- Base pipe
- Filtration media
- Outer protection shroud
- Integral expandable connector

III. Answer the following questions.

1. What is sand control?
2. What are the main situations which cause sand production?
3. What issues can sand production lead to?
4. What measures does passive sand control use?
5. What techniques are passive sand control methods?
6. What method relies on the use of filters to control sand production and it is known as intrusive measure?
7. What techniques are active sand control methods?
8. What passes through the screen?
9. What types of screens are used in oil and gas industry?
10. What is one of the oldest sand control methods?
11. What are the advantages of slotted liners?

12. Why are keystone slots considered to be a better choice than straight slots?
13. What is a wire wrapped screen?
14. What are the advantages of wire wrapped screens?
15. What are the main types of wire-wrap screens?
16. How can the wire-wrapped screen be used?
17. What is the critical part of having successful sand control with wire-wrapped screens?
18. Why will poorly sorted formation not be effective?
19. Why are the wire-wrapped screens typically used behind a gravel pack in a poorly sorted reservoir?
20. Where is a media gravel layer with or without resin coating placed?
21. What do thickness and size of a medium layer depend on?
22. What is the main concern about the pre-packed screen?
23. What are the main advantages about Carbolite?
24. What is a premium screen's design?
25. What are the main advantages of premium screens over other screens?
26. What does an expandable screen include?
27. What are the advantages of setting expandable screens against formation?

IV. Mark the sentences as True or False.

1. This is common requirement for several oil and gas producing wells around the world.
2. There are three situations which cause sand production.
3. Selective perforation is an active sand control method.
4. Once sand packs are developed around the screen, they will be like a filtration media which prevents sand to flowing into a wellbore.
5. There are four types of slots which are straight and keystone slots.
6. Keystone slots are generally less expensive than straight slots.
7. Wires wrapped around the vertical ribs are keystone shaped, which is designed for decreasing the chances of sand plugging the screen because it has a self-cleaning action.

8. Fine particles in a wellbore will flow with producing fluid and won't cause damage to downhole and surface equipment.
9. Pre-packed screen is similar to a wire-wrapped screen, and it has similar filtering media.
10. The metal mesh can be specially designed depending on each service providers or customer requirements.

V. Match the left and the right columns.

1. surface	a) liner
2. sand	b) failure
3. passive	c) industry
4. gravel	d) control
5. wire-wrapped	e) screen component
6. common	f) fluid
7. self-flush	g) pack
8. mechanical	h) facilities
9. gas	i) requirement
10. injection	j) sand control
11. filtration	k) slots
12. keystone	l) jacket
13. slotted	m) sand
14. well-sorted	n) ability
15. fine	o) media
16. internal	p) formations

VI. Complete the sentences with the missing words and expressions.

Screen plugging resistance, all metal design, running in long horizontal wells, the initial stage, each service providers or customer requirements, the surface of screen

Premium screens are an 1)_____ with a protective outer metal shroud and a metal mesh filtration. The main advantages of premium screens over other screens are 2) _____ and ability

to flow back drilling fluid through the screens. The metal mesh can be specially designed depending on 3)_____. Pore throat can vary from 60 micron to 300 micron and the ideas it that the mesh will prevent large particles and allow fine particles to flow through at 4) _____. Then large particles will form a permeable sand filter cake layer on 5)_____, which will prevent fine and large particle from flowing though. Premium screens are normally run behind gravel pack and they are famous for 6) _____.

VII. Match the synonyms:

1. mitigate	a) check
2. control	b) finish
3. stop	c) invent
4. large	d) by
5. create	e) mistake
6. near	f) big
7. failure	g) break
8. damage	h) decrease

VIII. Choose one of the listed topics, find more information and speak about it.

1. Slotted liner.
2. Wire-wrapped screen.
3. Pre-packed screen.
4. Premium screen.
5. Expandable sand screen

IX. Insert the missing prepositions:

With, about, around, to, without, about, in, of, by, on, of, with

Pre-packed screen is similar ___ a wire-wrapped screen but it has different filtering media. A media gravel layer ___ or ___ resin coating is placed ___ the internal screen component and is supported ___ an exter-

nal screen. Thickness and size ___ medium layer depend ___ well requirements, such as formation size, flow rate, hole size, etc. The main concern ___ the pre-packed screen is a chance ___ plugging it ___ completion fluid, drilling mud, etc. Therefore, ___ order to mitigate this issue, Carbolite proppant can be utilized as the main pack media rather than re-sieved gravel. There are several advantageous ___ Carbolite such as bigger pore throats, precise sorting grain size, and better permeability than normal re-sieved sand.

X. Fill in the gaps with the appropriate tense-aspect forms of the verbs.

Oil & gas well screens (*combine*) the hydraulic efficiency of wire-wound screens with the strength of pipe. Because of the strength of the pipe liner, the wrap wires can (*be*) smaller, producing a greater open area. The longitudinal support rods on the screen jacket (*create*) channels, which direct incoming flow to the nearest pipe perforation. Screen and pipe (*weld*) to make a rugged, reliable unit suitable for deep vertical wells and supply wells.

Slotted pipe with oil and gas standard (API standard) covered with fine screen giving out excellent sand control (*come*) together with extra high collapse strength to (*apply*) in oil dan gas well which mostly (*have*) extreme depth of drilling (up to 10.000 meters).

Sand control screen positioned in the wellbore (*serve*) to block out sand while allowing the flow through of oil or water. The screens giving precise particle size control (*compare*) to slotted pipe while maintaining the same high strength and durability, excellent corrosion resistance, high pressure tolerance.

Sand screen using bigger hole of slotted pipe wrapped with the screens (*increase*) containment capacity, production capacity and excellent backwash efficiency.

UNIT 5. VALVES

I. Read and translate the text.

The most common mechanical device used in process operations is the valve. The major valve parts are the body, the opening element, the stem, the handwheel (handle), the bonnet and the packing gland.

The body is the part of a valve that is attached to pipesand hold all the parts together. The gases or liquids flow through the body when the valve is open.

The opening element is the part that opens and closes the valve. All valves have an opening element in the valve body. Opening elements are made in various shapes and sizes. They can move up and down on a stem, or rotate around a central pivot point. The opening element stops or allows flow through a valve. When the valve is closed, the opening element fits against the valve seat.

The stem raises or lowers the opening element. In manually operated valves, the stem is usually threaded. In ball valves and butterfly valves, the stem does not go up or down. It turns inside the bonnet. In pneumatic and hydraulic valves, the threaded stem is replaced by a smooth rod that moves up and down in the valve.

On a manual valve, a hand wheel or handle is attached to the stem. The hand wheel or handle allows the operator to turn the stem. The hand wheel is held on the stem by the hand wheel nut.

The bonnet is a separate housing that is bolted tightly to the top of the valve body. The stem passes through the bonnet. The bonnet holds the stem in position.

The packing gland is held in place by bolts, or sometimes it is screwed into place. This gland keeps the packing tight. Packing is a soft material inside the bonnet, placed around the stem to make a tight seal. The packing gland keeps pressurized gas or liquid in the valve from escaping to the atmosphere.

Valves serve various functions within the piping system:

- Stopping and starting a fluid flow. Depending on whether a valve is open or closed, it let pass the process fluid or halt the fluid.
- Throttling the fluid flow. Some of the valves let you throttle the fluid depending open % of total opening. Lesser the opening higher the throttling and otherwise.
- Controlling the direction of a fluid flow. Multiport valve lets you decide the way fluid will go.

- Regulating a flow or pressure within the piping system. Some of the automatic control valves maintain the flow and pressure within the system by adjusting opening and closing.
- Relieve pressure or vacuum from the piping system and equipment. Pressure and vacuum relief valve safeguard the process system from overpressure and during vacuum condition.

II. Answer the following questions.

1. What is the most common mechanical device used in process operations?
2. What is the body?
3. What is the opening element?
4. What happens when the valve is closed?
5. What does the stem do?
6. What is the threaded stem replaced in pneumatic and hydraulic valves by?
7. What does the hand wheel or handle allow to do?
8. What is the hand wheel held on the stem by?
9. What is the bonnet?
10. What does the bonnet hold?
11. What is the packing gland held in place by?
12. What does the packing gland keep in the valve from escaping to the atmosphere?
13. What functions do valves serve within the piping system?

III. Match the left and the right columns.

1. pressurized	a) device
2. piping	b) material
3. mechanical	c) gland
4. fluid	d) gas
5. pivot	e) valves
6. opening	f) shapes
7. soft	g) seal
8. hydraulic	h) element

9. tight	i) operations
10. packing	j) point
11. major	k) flow
12. various	l) nut
13. vacuum	m) stem
14. hand wheel	n) valve parts
15. threaded	o) condition
16. process	p) system

IV. Insert the missing words and expressions:

Sizes, handle, opening element, pass the process fluid, bonnet, overpressure and during vacuum condition, manually operated valves, liquids, adjusting opening and closing

1. The major valve parts are the body, the _____, the stem, the handwheel (handle), the bonnet and the packing gland.
2. The gases or _____ flow through the body when the valve is open.
3. Opening elements are made in various shapes and _____.
4. In _____, the stem is usually threaded.
5. On a manual valve, a hand wheel or _____ is attached to the stem.
6. Packing is a soft material inside the _____, placed around the stem to make a tight seal.
7.Depending on whether a valve is open or closed, it let _____ or halt the fluid.
8. Some of the automatic control valves maintain the flow and pressure within the system by _____.
9. Pressure and vacuum relief valve safeguard the process system from _____.

V. Fill in the gaps with the appropriate tense-aspect forms of the verbs.

Valves (*use*) to minimize the hazards associated with the transfer of fluids by providing methods of controlling or isolating the pressure and flow of fluids. It (*be*) mainly when valves (*fail*) that hazards (*arise*), depending on the chemical and physical nature of the fluid being handled. Often the failure of a valve (*go*) unnoticed as they (*situate*) within the pipe where their operation cannot (*see*). Extra precautions should (*take*) when performing tasks that (*rely*) on the correct operation of a valve. For example, when pipelines (*dismantle*) for maintenance, any isolating valves in the system must (*close*) and if possible, the pipeline drained. Adequate safety equipment should (*wear*) and pipelines opened slowly to prevent large amounts of fluid leaking out in the event of an isolation valve failure.

Any valve that (*stick*) should not (*force*) open as this may (*cause*) fluid to leak out past the stem and onto operators. Any valves that (*know*) to be leaking, either internally or externally, should (*report*) and (*change*) as soon as possible. Any unusual trends in valve operation should also (*report*) but no adjustments should (*make*) without prior consultation with senior personnel and investigations carried out to discover the reasons for the unusual trend.

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

Valves for fluid handling are used for controlling the flow of liquids, gases and slurries in a pipe or other enclosure, as directed by a signal from a controller. Control valves enable the direct control of flow rates of fluids, therefore controlling process quantities such fluid level, temperature and pressure. Fluid process valves are of seven main types: gate valves, globe valves, plug valves, needle valves, butterfly valves.

Gate valves (also known as sluice valves), are valves which open by lifting a rectangular or round wedge/gate out of the path of the fluid. The distinct feature of gate valves are the sealing surfaces between the gate and seats are planar. Because of this gate valves are often used when a straight-line flow of fluid and minimum restriction is desired. Gate valves are designed for fully open or fully closed service. They are installed in pipelines as isolating valves, and should not be used as control

or regulating valves. Operation of a gate valve is performed doing an either clockwise to close (CTC) or clockwise to open (CTO) rotating motion of the stem. When operating the valve stem, the gate moves up- or downwards on the threaded part of the stem.

As their name suggests, globe valves are linear motion valves with rounded globular shaped bodies. Globe valves, different from ball valve, are types of valves used for regulating flow in a pipeline, consisting of a movable disk-type element and a stationary ring seat in a generally spherical body. Globe valves are named for their spherical body shape with the two halves of the body being separated by an internal baffle. Globe valves are manufactured in a variety of materials and styles some of which include corrosion resistant, pressure seal and cryogenic globe valves. Globe valves can be used in systems that require frequent stroking, vacuum, and systems that have a wide range of temperature extremes.

Plug valves are valves with cylindrical or conically tapered "plugs" which can be rotated inside the valve body to control flow through the valve. Plug valves (or cock or stop-cock valves or quater-turn valves) date back to ancient times, where they were developed for use in citywide Roman plumbing systems. Today, they remain one of the most widely used valves for both on/off and throttling services. The plugs in plug valves have one or more hollow passageways going sideways through the plug, so that fluid can flow through the plug when the valve is open. Plug valves are simple and often economical. Plug valve design is fairly simple; the body is comprised of three main parts: body, cover, and plug.

Needle valves are a type of valve having a small port and a threaded, needle-shaped plunger. It allows precise regulation of flow, although it is generally only capable of relatively low flow rates. Needle valves are similar to globe valves. They’re used to start, stop, and regulate the flow rate within a pipeline. However, needle valves are designed differently. Unlike globe valves, which have a disc, needle valves have a long, tapered, needle-like point at the end of the valve stem. This is often referred to as the plunger.

Butterfly valves are straightforward on/off routing valves with a substantial opening area and low flow resistance. They are an optimal solution in modern processing technology and ideal for use with low and

medium-viscosity liquids. Butterfly valves are valves that isolate or regulate the flow of a fluid. The closing mechanism is a disk that rotates. A butterfly valve is from a family of valves called quarter-turn valves.

Control valves regulate the flow or pressure of a fluid. Control valves normally respond to signals generated by independent devices such as flow meters or temperature gauges. Control valves are normally fitted with actuators and positioners. Pneumatically-actuated globe valves and diaphragm valves are widely used for control purposes in many industries, although quarter-turn types such as (modified) ball, gate and butterfly valves are also used. Control valves can also work with hydraulic actuators (also known as hydraulic pilots). These types of valves are also known as automatic control valves.

Diaphragm valves (also known as membrane valves) consist of a valve body with two or more ports, a diaphragm, and a "weir or saddle" or seat upon which the diaphragm closes the valve. The valve is constructed from either plastic or metal. Diaphragm valves are used on shut-off and throttling service for liquids, slurries and vacuum/gas.

VII. Answer the following questions.

1. What are valves for fluid handling used for?
2. What do control valves enable?
3. How many main types are fluid process valves of?
4. What are gate valves?
5. What is the distinct feature of gate valves?
6. Why are gate valves often used when a straight-line flow of fluid and minimum restriction is desired?
7. What service are gate valves designed for?
8. How is the operation of a gate valve performed?
9. What are globe valves?
10. What are globe valves used for?
11. What are globe valves manufactured in?
12. Where can globe valves be used?
13. What are plug valves?
14. Where were plug valves developed?
15. What are the advantages of plug valves?

16. What are needle valves?
17. What do they allow?
18. What are butterfly valves?
19. What are they used for?
20. What do control valves regulate?
21. What do diaphragm valves consist of?
22. What are diaphragm valves constructed from?
23. What are diaphragm valves used on?

VIII. Match the left and the right columns.

1. direct	a) types
2. fluid	b) control
3. round	c) feature
4. main	d) handling
5. minimum	e) wedge
6. distinct	f) surfaces
7. rotating	g) restriction
8. sealing	h) service
9. stationary ring	i) motion
10. fully closed	j) bodies
11. internal	k) extremes
12. rounded globular shaped	l) seat
13. temperature	m) element
14. spherical	n) baffle
15. movable disk-type	o) body

IX. Insert the missing prepositions:

By, of, in, with, of, to, for, with, of, upon, for, with, on, from

Control valves regulate the flow or pressure ___ a fluid. Control valves normally respond ___ signals generated ___ independent devices such as flow meters or temperature gauges. Control valves are normally

fitted ___ actuators and positioners. Pneumatically-actuated globe valves and diaphragm valves are widely used ___ control purposes ___ many industries, although quarter-turn types such as (modified) ball, gate and butterfly valves are also used. Control valves can also work ___ hydraulic actuators (also known as hydraulic pilots). These types ___ valves are also known as automatic control valves.

Diaphragm valves (also known as membrane valves) consist ___ a valve body ___ two or more ports, a diaphragm, and a "weir or saddle" or seat ___ which the diaphragm closes the valve. The valve is constructed ___ either plastic or metal. Diaphragm valves are used ___ shut-off and throttling service ___ liquids, slurries and vacuum/gas.

X. Choose one of the listed topics, find more information and speak about it.

1. Gate valves.
2. Globe valves.
3. Plug valves.
4. Needle valves.
5. Butterfly valves.

XI. Fill in the gaps with the appropriate tense-aspect forms of the verbs.

In a ball valve, the opening element (*be*) a ball with a hole through the center. When the valve (*be*) fully open, gas or liquid (*flow*) through the valve easily. The hole in the ball (*be*) the same size as the pipe, so there (*be*) no obstruction to flow.

The ball element (*rotate*) within the valve body to open and close the valve. Large ball valves (*operate*) by hand wheels. Small ball valves (*have*) a handle, connected to the stem that turns the ball.

A one-quarter turn of the valve stem (*rotate*) the ball 90°. This (*be*) enough to move the valve from a full open to a full closed position. Ball valves (*have*) the advantage that they can (*open*) and (*close*) more quickly. They (*use*) in high-pressure liquid and gas pipelines as quick shutoff valves.

Ball valves usually (*set*) in a fully open or fully closed position. Because of their construction, ball valves can (*open*) slowly without damage to the ball. For this reason, they can (*use*) as bypass valves. By-pass valves (*open*) slowly to allow pressure to build up gradually in a pipeline. Both ball valves and butterfly valves (*open*) and (*close*) with a 90° turn.

XII. Find 9 words from the unit:

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

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